

WHAT IS CLAIMED IS:

1. A human interleukin-3 mutant polypeptide
Formula I:

5 Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr Ser Trp Val Asn
1 5 10 15

Cys Xaa
20 25 30
10

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Xaa Xaa Xaa Xaa Xaa Xaa
35 40 45

Xaa
15 50 55 60

Xaa
65 70 75

20 Xaa
80 85 90

Xaa
95 100 105
25

Xaa Phe Xaa
110 115 120

30 Xaa Xaa Xaa Gln Gln Thr Thr Leu Ser Leu Ala Ile Phe [SEQ ID
125 130

NO:15)

35 wherein Xaa at position 17 is Ser, Lys, Gly, Asp, Met, Gln, or
Arg;

Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;
Xaa at position 19 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;

Xaa at position 20 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;
 Xaa at position 21 is Asp, Phe, Lys, Arg, Ala, Gly, Glu, Gln, Asn,
 Thr, Ser or
 Val;

5 Xaa at position 22 is Glu, Trp, Pro, Ser, Ala, His, Asp, Asn, Gln,
 Leu, Val or
 Gly;

Xaa at position 23 is Ile, Val, Ala, Leu, Gly, Trp, Lys, Phe,
 Leu, Ser, or Arg;

10 Xaa at position 24 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;
 Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;
 Xaa at position 26 is His, Thr, Phe, Gly, Arg, Ala, or Trp;
 Xaa at position 27 is Leu, Gly, Arg, Thr, Ser, or Ala;
 Xaa at position 28 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;

15 Xaa at position 29 is Gln, Asn, Leu, Pro, Arg, or Val;
 Xaa at position 30 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or
 Lys;

Xaa at position 31 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;
 Xaa at position 32 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;

20 Xaa at position 33 is Pro, Leu, Gln, Ala, Thr, or Glu;
 Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Glu, Gln, Thr, Arg,
 Ala, Phe,
 Ile or Met;

Xaa at position 35 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;

25 Xaa at position 36 is Asp, Leu, or Val;
 Xaa at position 37 is Phe, Ser, Pro, Trp, or Ile;
 Xaa at position 38 is Asn, or Ala;
 Xaa at position 40 is Leu, Trp, or Arg;

Xaa at position 41 is Asn, Cys, Arg, Leu, His, Met, or Pro;

30 Xaa at position 42 is Gly, Asp, Ser, Cys, Asn, Lys, Thr, Leu, Val,
 Glu, Phe,
 Tyr, Ile, Met or Ala;

Xaa at position 43 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala, Cys, Gln,
 Arg, Thr,

35 Gly or Ser;

Xaa at position 44 is Asp, Ser, Leu, Arg, Lys, Thr, Met, Trp, Glu,
 Asn, Gln,

Ala or Pro;
Xaa at position 45 is Gln, Pro, Phe, Val, Met, Leu, Thr, Lys, Trp,
Asp, Asn,
Arg, Ser, Ala, Ile, Glu or His;
5 Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, Glu, Asn, Gln, Lys,
His, Ala,
Tyr, Ile, Val or Gly;
Xaa at position 47 is Ile, Gly, Val, Ser, Arg, Pro, or His;
Xaa at position 48 is Leu, Ser, Cys, Arg, Ile, His, Phe, Glu, Lys,
10 Thr, Ala,
Met, Val or Asn;
Xaa at position 49 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;
Xaa at position 50 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn, Ser, Ala,
Ile, Val,
15 His, Phe, Met or Gln;
Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;
Xaa at position 52 is Asn, His, Arg, Leu, Gly, Ser, or Thr;
Xaa at position 53 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser, or
Met;
20 Xaa at position 54 is Arg, Asp, Ile, Ser, Val, Thr, Gln, Asn, Lys,
His, Ala or Leu;
Xaa at position 55 is Arg, Thr, Val, Ser, Leu, or Gly;
Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, Glu, Arg, His,
Thr, Ala, Tyr, Phe, Leu, Val or Lys;
25 Xaa at position 57 is Asn or Gly;
Xaa at position 58 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;
Xaa at position 59 is Glu Tyr, His, Leu, Pro, or Arg;
Xaa at position 60 is Ala, Ser, Pro, Tyr, Asn, or Thr;
Xaa at position 61 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;
30 Xaa at position 62 is Asn His, Val, Arg, Pro, Thr, Asp, or Ile;
Xaa at position 63 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;
Xaa at position 64 is Ala, Asn, Pro, Ser, or Lys;
Xaa at position 65 is Val, Thr, Pro, His, Leu, Phe, or Ser;
Xaa at position 66 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;
35 Xaa at position 67 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or
His;
Xaa at position 68 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or Leu;

Xaa at position 70 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 71 is Ala, Met, Leu, Pro, Arg, Glu, Thr, Gln,

5 Trp, or Asn;

Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

Xaa at position 74 is Ile, Met, Thr, Pro, Arg, Gly, Ala;

Xaa at position 75 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser,

10 Gln, or Leu;

Xaa at position 76 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or Asp;

Xaa at position 77 is Ile, Ser, Arg, Thr, or Leu;

Xaa at position 78 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;

15 Xaa at position 79 is Lys, Thr, Asn, Met, Arg, Ile, Gly, or Asp;

Xaa at position 80 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;

Xaa at position 81 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;

Xaa at position 82 is Leu, Gln, Lys, Trp, Arg, Asp, Glu, Asn, His,

20 Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

Xaa at position 83 is Pro, Ala, Thr, Trp, Arg, or Met;

Xaa at position 84 is Cys, Glu, Gly, Arg, Met, or Val;

Xaa at position 85 is Leu, Asn, Val, or Gln;

Xaa at position 86 is Pro, Cys, Arg, Ala, or Lys;

25 Xaa at position 87 is Leu, Ser, Trp, or Gly;

Xaa at position 88 is Ala, Lys, Arg, Val, or Trp;

Xaa at position 89 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or Ser;

Xaa at position 90 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;

30 Xaa at position 91 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;

Xaa at position 92 is Pro, Phe, Arg, Ser, Lys, His, Ala, Gly, Ile or Leu;

Xaa at position 93 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;

Xaa at position 94 is Arg, Ile, Ser, Glu, Leu, Val, Gln, Lys, His,

35 Ala, or

Pro;

Xaa at position 95 is His, Gln, Pro, Arg, Val, Leu, Gly, Thr, Asn,

Lys, Ser,
 Ala, Trp, Phe, Ile, or Tyr;
 Xaa at position 96 is Pro, Lys, Tyr, Gly, Ile, or Thr;
 Xaa at position 97 is Ile, Val, Lys, Ala, or Asn;
 5 Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr,
 Glu, Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;
 Xaa at position 99 is Ile, Leu, Arg, Asp, Val, Pro, Gln,
 Gly, Ser, Phe, or His;
 Xaa at position 100 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln,
 10 or Pro;
 Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val,
 Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu, or Gln;
 Xaa at position 102 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;
 Xaa at position 103 is Asp, or Ser;
 15 Xaa at position 104 is Trp, Val, Cys, Tyr, Thr, Met, Pro, Leu,
 Gln, Lys, Ala, Phe, or Gly;
 Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr,
 Leu, Lys, Ile, Asp, or His;
 Xaa at position 106 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;
 20 Xaa at position 108 is Arg, Lys, Asp, Leu, Thr, Ile, Gln, His, Ser,
 Ala or
 Pro;
 Xaa at position 109 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;
 Xaa at position 110 is Lys, Ala, Asn, Thr, Leu, Arg, Gln, His, Glu,
 25 Ser, Ala,
 or Trp;
 Xaa at position 111 is Leu, Ile, Arg, Asp, or Met;
 Xaa at position 112 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;
 Xaa at position 113 is Phe, Ser, Cys, His, Gly, Trp, Tyr, Asp,
 30 Lys, Leu, Ile, Val or Asn;
 Xaa at position 114 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;
 Xaa at position 115 is Leu, Asn, Val, Pro, Arg, Ala, His, Thr,
 Trp, or Met;
 Xaa at position 116 is Lys, Leu, Pro, Thr, Met, Asp, Val, Glu,
 35 Arg, Trp, Ser, Asn, His, Ala, Tyr, Phe, Gln, or Ile;
 Xaa at position 117 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;
 Xaa at position 118 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;

Xaa at position 119 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;
Xaa at position 120 is Asn, Ala, Pro, Leu, His, Val, or Gln;
Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or
Gly;

- 5 Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,
Ile, Tyr, or Cys;
Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

and which can additionally have Met- preceding the amino acid in position 1; and wherein from 1 to 14 amino acids can be deleted from the N-terminus and/or from 1 to 15 amino acids can be deleted from the C-terminus; and wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding amino acids of native (1-133) human interleukin-3.

15

2. A human interleukin-3 mutant polypeptide of the

20 Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr Ser Trp Val Asn
1 5 10 15

Cys Xaa Xaa Xaa Xaa Xaa Glu Xaa Xaa Xaa Xaa Leu Xaa Xaa Xaa
20 25 30

25 Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Leu Xaa Xaa Glu Xaa Xaa
35 40 45

Xaa Xaa Leu Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Leu Xaa Xaa
30 50 55 60

35 xaa Xaa Leu Xaa Xaa Xaa Xaa Cys Xaa Pro Xaa Xaa Xaa Xaa
80 85 90

Xaa Xaa Xaa Arg Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asp Xaa Xaa

95 100

105

Xaa Phe Xaa Xaa Lys Leu Xaa Phe Xaa Xaa Xaa Xaa Leu Xaa Xaa

5 110 115

120

Xaa Xaa Xaa Gln Gln Thr Thr Leu Ser Leu Ala Ile Phe [SEQ ID NO:16]

125 130

wherein

- 10 Xaa at position 17 is Ser, Gly, Asp, Met, or Gln;
Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;
Xaa at position 19 is Met, Phe, Ile, Arg, or Ala;
Xaa at position 20 is Ile or Pro;
Xaa at position 21 is Asp or Glu;
- 15 Xaa at position 23 is Ile, Val, Ala, Leu, or Gly;
Xaa at position 24 is Ile, Val, Phe, or Leu;
Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;
Xaa at position 26 is His, Phe, Gly, Arg, or Ala;
Xaa at position 28 is Lys, Leu, Gln, Gly, Pro, or Val;
- 20 Xaa at position 29 is Gln, Asn, Leu, Arg, or Val;
Xaa at position 30 is Pro, His, Thr, Gly, or Gln;
Xaa at position 31 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;
Xaa at position 32 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;
Xaa at position 33 is Pro, Leu, Gln, Ala, or Glu;
- 25 Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Ala, Arg, Gln, Glu,
Ile, Phe, Thr or Met;
Xaa at position 35 is Leu, Ala, Asn, Pro, Gln, or Val;
Xaa at position 36 is Asp or Leu;
Xaa at position 37 is Phe, Ser, Pro, Trp, or Ile;
- 30 Xaa at position 38 is Asn or Ala;
Xaa at position 41 is Asn, Cys, Arg, His, Met, or Pro;
Xaa at position 42 is Gly, Asp, Ser, Cys, Ala, Asn, Ile, Leu, Met,
Tyr, Val or Arg;
Xaa at position 44 is Asp or Glu;
- 35 Xaa at position 45 is Gln, Val, Met, Leu, Thr, Lys, Ala, Asn, Glu,
Ser, or Trp;
Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, Ala, Asn, Gln, Glu,

His, Ile, Lys, Tyr, Val or Gly;
 Xaa at position 47 is Ile, Val, or His;
 Xaa at position 49 is Met, Asn, or Asp;
 Xaa at position 50 is Glu, Thr, Ala, Asn, Ser or Asp;
 5 Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;
 Xaa at position 52 is Asn or Gly;
 Xaa at position 53 is Leu, Met, or Phe;
 Xaa at position 54 is Arg, Ala, or Ser;
 Xaa at position 55 is Arg, Thr, Val, Leu, or Gly;
 10 Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, Ala, Arg, Asn, Glu,
 His, Leu,
 Thr, Val or Lys;
 Xaa at position 59 is Glu, Tyr, His, Leu, or Arg;
 Xaa at position 60 is Ala, Ser, Asn, or Thr;
 15 Xaa at position 61 is Phe or Ser;
 Xaa at position 62 is Asn, Val, Pro, Thr, or Ile;
 Xaa at position 63 is Arg, Tyr, Lys, Ser, His, or Val;
 Xaa at position 64 is Ala or Asn;
 Xaa at position 65 is Val, Thr, Leu, or Ser;
 20 Xaa at position 66 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;
 Xaa at position 67 is Ser, Phe, Val, Gly, Asn, Ile, or His;
 Xaa at position 68 is Leu, Val, Ile, Phe, or His;
 Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, or Gly;
 Xaa at position 70 is Asn or Pro;
 25 Xaa at position 71 is Ala, Met, Pro, Arg, Glu, Thr, or Gln;
 Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;
 Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, Arg, or
 Pro;
 Xaa at position 74 is Ile or Met;
 30 Xaa at position 75 is Glu, Gly, Asp, Ser, or Gln;
 Xaa at position 76 is Ser, Val, Ala, Asn, Glu, Pro, Gly, or
 Asp;
 Xaa at position 77 is Ile, Ser, or Leu;
 Xaa at position 79 is Lys, Thr, Gly, Asn, Met, Arg, Ile, Gly, or
 35 Asp;
 Xaa at position 80 is Asn, Val, Gly, Thr, Leu, Glu, or Arg;
 Xaa at position 81 is Leu, or Val;

Xaa at position 82 is Leu, Gln, Trp, Arg, Asp, Ala, Asn, Glu, His,
Met, Phe, Ser, Thr, Tyr or Val;
Xaa at position 83 is Pro, Ala, Thr, Trp, or Met;
Xaa at position 85 is Leu or Val;
5 Xaa at position 87 is Leu or Ser;
Xaa at position 88 is Ala, Arg, or Trp;
Xaa at position 89 is Thr, Asp, Glu, His, Asn, or Ser;
Xaa at position 90 is Ala, Asp, or Met;
Xaa at position 91 is Ala, Pro, Ser, Thr, Phe, Leu, or Asp;
10 Xaa at position 92 is Pro or Ser;
Xaa at position 93 is Thr, Asp, Ser, Pro, Ala, Leu, or Arg;
Xaa at position 95 is His, Pro, Arg, Val, Leu, Gly, Asn, Ile, Phe,
Ser or Thr;
Xaa at position 96 is Pro or Tyr;
15 Xaa at position 97 is Ile, Val, or Ala;
Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr, Leu, Arg,
Gln, Glu,
Lys, Met, Ser, Tyr, Val or Pro;
Xaa at position 99 is Ile, Leu, Val, or Phe;
20 Xaa at position 100 is Lys, Leu, His, Arg, Ile, Gln, Pro, or
Ser;
Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val,
Asn, Ile, Leu or Tyr;
Xaa at position 102 is Gly, Glu, Lys, or Ser;
25 Xaa at position 104 is Trp, Val, Tyr, Met, or Leu;
Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr,
Leu, Lys, Ile, Asp, or His;
Xaa at position 106 is Glu, Ser, Ala, or Gly;
Xaa at position 108 is Arg, Ala, Gln, Ser or Lys;
30 Xaa at position 109 is Arg, Thr, Glu, Leu, Ser, or Gly;
Xaa at position 112 is Thr, Val, Gln, Glu, His, or Ser;
Xaa at position 114 is Tyr or Trp;
Xaa at position 115 is Leu or Ala;
Xaa at position 116 is Lys, Thr, Met, Val, Trp, Ser, Leu, Ala, Asn,
35 Gln, His, Met, Phe, Tyr or Ile;
Xaa at position 117 is Thr, Ser, or Asn;
Xaa at position 119 is Glu, Ser, Pro, Leu, Thr, or Tyr;

Xaa at position 120 is Asn, Pro, Leu, His, Val, or Gln;

Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or Gly;

5 Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His, Ile, Tyr, or Cys;

Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

and which can additionally have Met- preceding the amino acid in position 1; and wherein from 1 to 14 amino acids can be deleted 10 from the N-terminus and/or from 1 to 15 amino acids can be deleted from the C-terminus; and wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding amino acids of native (1-133) human interleukin-3.

15 3. A human interleukin-3 mutant polypeptide according to claim 2 of the Formula III:

Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr Ser Trp Val Asn
1 5 10 15

20 Cys Xaa Xaa Xaa Ile Xaa Glu Xaa Xaa Xaa Xaa Leu Lys Xaa Xaa
20 25 30

Xaa Xaa Xaa Xaa Xaa Asp Xaa Xaa Asn Leu Asn Xaa Glu Xaa Xaa
25 35 40 45

Xaa Ile Leu Met Xaa Xaa Asn Leu Xaa Xaa Xaa Asn Leu Glu Xaa
50 55 60

30 Phe Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Xaa Xaa Ile Glu
65 70 75

Xaa Xaa Leu Xaa Xaa Leu Xaa Xaa Cys Xaa Pro Xaa Xaa Thr Ala
80 85 90

35 Xaa Pro Xaa Arg Xaa Xaa Xaa Xaa Xaa Xaa Gly Asp Xaa Xaa
95 100 105

Xaa Phe Xaa Xaa Lys Leu Xaa Phe Xaa Xaa Xaa Xaa Leu Glu Xaa
110 115 120

5 Xaa Xaa Xaa Gln Gln Thr Thr Leu Ser Leu Ala Ile Phe [SEQ ID NO:17]
125 130

wherein

Xaa at position 17 is Ser, Gly, Asp, Met, or Gln;
10 Xaa at position 18 is Asn, His, or Ile;
Xaa at position 19 is Met or Ile;
Xaa at position 21 is Asp or Glu;
Xaa at position 23 is Ile, Ala, Leu, or Gly;
Xaa at position 24 is Ile, Val, or Leu;
15 Xaa at position 25 is Thr, His, Gln, or Ala;
Xaa at position 26 is His or Ala;
Xaa at position 29 is Gln, Asn, or Val;
Xaa at position 30 is Pro, Gly, or Gln;
Xaa at position 31 is Pro, Asp, Gly, or Gln;
20 Xaa at position 32 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;
Xaa at position 33 is Pro or Glu;
Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Ala, Arg, Gln,
Glu, Ile, Phe, Thr or Met;
Xaa at position 35 is Leu, Ala, Asn, Pro, Gln, or Val;
25 Xaa at position 37 is Phe, Ser, Pro, or Trp;
Xaa at position 38 is Asn or Ala;
Xaa at position 42 is Gly, Asp, Ser, Cys, Ala, Asn, Ile, Leu,
Met, Tyr or Arg;
Xaa at position 44 is Asp or Glu;
30 Xaa at position 45 is Gln, Val, Met, Leu, Thr, Ala, Asn, Glu,
Ser or Lys;
Xaa at position 46 is Asp, Phe, Ser, Thr, Ala, Asn Gln, Glu, His,
Ile, Lys, Tyr, Val or Cys;
Xaa at position 50 is Glu, Ala, Asn, Ser or Asp;
35 Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;
Xaa at position 54 is Arg or Ala;
Xaa at position 55 is Arg, Thr, Val, Leu, or Gly;

Xaa at position 56 is Pro, Gly, Ser, Gln, Ala, Arg, Asn, Glu,
Leu, Thr, Val or Lys;

Xaa at position 60 is Ala or Ser;

Xaa at position 62 is Asn, Pro, Thr, or Ile;

5 Xaa at position 63 is Arg or Lys;

Xaa at position 64 is Ala or Asn;

Xaa at position 65 is Val or Thr;

Xaa at position 66 is Lys or Arg;

Xaa at position 67 is Ser, Phe, or His;

10 Xaa at position 68 is Leu, Ile, Phe, or His;

Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, or Gly;

Xaa at position 71 is Ala, Pro, or Arg;

Xaa at position 72 is Ser, Glu, Arg, or Asp;

Xaa at position 73 is Ala or Leu;

15 Xaa at position 76 is Ser, Val, Ala, Asn, Glu, Pro, or Gly;

Xaa at position 77 is Ile or Leu;

Xaa at position 79 is Lys, Thr, Gly, Asn, Met, Arg, Ile, Gly, or
Asp;

Xaa at position 80 is Asn, Gly, Glu, or Arg;

20 Xaa at position 82 is Leu, Gln, Trp, Arg, Asp, Ala, Asn, Glu, His,
Ile, Met, Phe, Ser, Thr, Tyr or Val;

Xaa at position 83 is Pro or Thr;

Xaa at position 85 is Leu or Val;

Xaa at position 87 is Leu or Ser;

25 Xaa at position 88 is Ala or Trp;

Xaa at position 91 is Ala or Pro;

Xaa at position 93 is Thr, Asp, Ser, Pro, Ala, Leu, or Arg;

Xaa at position 95 is His, Pro, Arg, Val, Leu, Gly, Asn, Phe, Ser
or Thr;

30 Xaa at position 96 is Pro or Tyr;

Xaa at position 97 is Ile or Val;

Xaa at position 98 is His, Ile, Asn, Leu, Ala, Thr, Leu, Arg, Gln,
Leu, Lys, Met, Ser, Tyr, Val or Pro;

Xaa at position 99 is Ile, Leu, or Val;

35 Xaa at position 100 is Lys, Arg, Ile, Gln, Pro, or Ser;

Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Pro, Asn,
Ile, Leu or Tyr;

Xaa at position 104 is Trp or Leu;
Xaa at position 105 is Asn, Pro, Ala, Ser, Trp, Gln, Tyr, Leu,
Lys, Ile, Asp, or His;
Xaa at position 106 is Glu or Gly;
5 Xaa at position 108 is Arg, Ala, or Ser;
Xaa at position 109 is Arg, Thr, Glu, Leu, or Ser;
Xaa at position 112 is Thr, Val, or Gln;
Xaa at position 114 is Tyr or Trp;
Xaa at position 115 is Leu or Ala;
10 Xaa at position 116 is Lys, Thr, Val, Trp, Ser, Ala, His, Met,
Phe, Tyr or Ile;
Xaa at position 117 is Thr or Ser;
Xaa at position 120 is Asn, Pro, Leu, His, Val, or Gln;
Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Asp, or Gly;
15 Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,
Ile, Tyr, or Cys;
Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

and which can additionally have Met- preceding the amino acid in
20 position 1; and wherein from 1 to 14 amino acids can be deleted
from the N-terminus and/or from 1 to 15 amino acids can be deleted
from the C-terminus; and wherein from 4 to 35 of the amino acids
designated by Xaa are different from the corresponding amino acids
of native (1-133)human interleukin-3.

25

4. A human interleukin-3 mutant polypeptide according
to Claim 3 of the Formula IV:

Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr Ser Trp Val Asn
30 1 5 10 15

Cys Xaa Xaa Met Ile Asp Glu Xaa Ile Xaa Xaa Leu Lys Xaa Xaa
20 25 30

35 Pro Xaa Pro Xaa Xaa Asp Phe Xaa Asn Leu Asn Xaa Glu Asp Xaa
35 40 45

Xaa Ile Leu Met Xaa Xaa Asn Leu Arg Xaa Xaa Asn Leu Glu Ala

50	55	60
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Phe Xaa Arg Xaa Xaa Lys Xaa Xaa Xaa Asn Ala Ser Ala Ile Glu

5	65	70	75
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Xaa Xaa Leu Xaa Xaa Leu Xaa Pro Cys Leu Pro Xaa Xaa Thr Ala

80	85	90
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10 Xaa Pro Xaa Arg Xaa Pro Ile Xaa Xaa Xaa Xaa Gly Asp Trp Xaa

95	100	105
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Glu Phe Xaa Xaa Lys Leu Xaa Phe Tyr Leu Xaa Xaa Leu Glu Xaa

110	115	120
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15

Xaa Xaa Xaa Gln Gln Thr Thr Leu Ser Leu Ala Ile Phe [SEQ ID NO:18]

125	130
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wherein

Xaa at position 17 is Ser, Gly, Asp, or Gln;

20 Xaa at position 18 is Asn, His, or Ile;

Xaa at position 23 is Ile, Ala, Leu, or Gly;

Xaa at position 25 is Thr, His, or Gln;

Xaa at position 26 is His or Ala;

Xaa at position 29 is Gln or Asn;

25 Xaa at position 30 is Pro or Gly;

Xaa at position 32 is Leu, Arg, Asn, or Ala;

Xaa at position 34 is Leu, Val, Ser, Ala, Arg, Gln, Glu, Ile,

Phe, Thr, or Met;

Xaa at position 35 is Leu, Ala, Asn, or Pro;

30 Xaa at position 38 is Asn or Ala;

Xaa at position 42 is Gly, Asp, Ser, Ala, Asn, Ile, Leu, Met,

Tyr or Arg;

Xaa at position 45 is Gln, Val, Met, Leu, Ala, Asn, Glu, or Lys;

Xaa at position 46 is Asp, Phe, Ser, Gln, Glu, His, Val

35 or Thr;

Xaa at position 50 is Glu Asn, Ser or Asp;

Xaa at position 51 is Asn, Arg, Pro, Thr, or His;

Xaa at position 55 is Arg, Leu, or Gly;
 Xaa at position 56 is Pro, Gly, Ser, Ala, Asn, Val, Leu or Gln;
 Xaa at position 62 is Asn, Pro, or Thr;
 Xaa at position 64 is Ala or Asn;
 5 Xaa at position 65 is Val or Thr;
 Xaa at position 67 is Ser or Phe;
 Xaa at position 68 is Leu or Phe;
 Xaa at position 69 is Gln, Ala, Glu, or Arg;
 Xaa at position 76 is Ser, Val, Asn, Pro, or Gly;
 10 Xaa at position 77 is Ile or Leu;
 Xaa at position 79 is Lys, Gly, Asn, Met, Arg, Ile, or Gly;
 Xaa at position 80 is Asn, Gly, Glu, or Arg;
 Xaa at position 82 is Leu, Gln, Trp, Arg, Asp, Asn, Glu, His, Met,
 Phe, Ser, Thr, Tyr or Val;
 15 Xaa at position 87 is Leu or Ser;
 Xaa at position 88 is Ala or Trp;
 Xaa at position 91 is Ala or Pro;
 Xaa at position 93 is Thr, Asp, or Ala;
 Xaa at position 95 is His, Pro, Arg, Val, Gly, Asn, Ser or Thr;
 20 Xaa at position 98 is His, Ile, Asn, Ala, Thr, Gln, Glu,
 Lys, Met, Ser, Tyr, Val or Leu;
 Xaa at position 99 is Ile or Leu;
 Xaa at position 100 is Lys or Arg;
 Xaa at position 101 is Asp, Pro, Met, Lys, Thr, His, Pro, Asn, Ile,
 25 Leu or Tyr;
 Xaa at position 105 is Asn, Pro, Ser, Ile or Asp;
 Xaa at position 108 is Arg, Ala, or Ser;
 Xaa at position 109 is Arg, Thr, Glu, Leu, or Ser;
 Xaa at position 112 is Thr or Gln;
 30 Xaa at position 116 is Lys, Val, Trp, Ala, His, Phe, Tyr or Ile;
 Xaa at position 117 is Thr or Ser;
 Xaa at position 120 is Asn, Pro, Leu, His, Val, or Gln;
 Xaa at position 121 is Ala, Ser, Ile, Pro, or Asp;
 Xaa at position 122 is Gln, Met, Trp, Phe, Pro, His, Ile, or Tyr;
 35 Xaa at position 123 is Ala, Met, Glu, Ser, or Leu;

and which can additionally have Met- preceding the amino acid in

position 1; and wherein from 1 to 14 amino acids can be deleted from the N-terminus and/or from 1 to 15 amino acids can be deleted from the C-terminus; and wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding amino acids of native (1-133)human interleukin-3.

5. The human interleukin-3 mutant polypeptide of claim 1 wherein 1-15 amino acids are deleted from the C-terminus and/or 1-14 amino acids are deleted from the N-terminus.

10

6. The human interleukin-3 mutant polypeptide of claim 1 wherein;

Xaa at position 42 is Gly, Asp, Ser, Ile, Leu, Met, Tyr, or Ala;
15 Xaa at position 45 is Gln, Val, Met or Asn;
Xaa at position 46 is Asp, Ser, Gln, His or Val;
Xaa at position 50 is Glu or Asp;
Xaa at position 51 is Asn, Pro or Thr;
Xaa at position 62 is Asn or Pro;
20 Xaa at position 76 is Ser, or Pro;
Xaa at position 82 is Leu, Trp, Asp, Asn Glu, His, Phe, Ser or Tyr;
Xaa at position 95 is His, Arg, Thr, Asn or Ser;
Xaa at position 98 is His, Ile, Leu, Ala, Gln, Lys, Met, Ser,
Tyr or Val;
25 Xaa at position 100 is Lys or Arg;
Xaa at position 101 is Asp, Pro, His, Asn, Ile or Leu;
Xaa at position 105 is Asn, or Pro;
Xaa at position 108 is Arg, Ala, or Ser;
Xaa at position 116 is Lys, Val, Trp, Ala, His, Phe, or Tyr;
30 Xaa at position 121 is Ala, or Ile;
Xaa at position 122 is Gln, or Ile; and
Xaa at position 123 is Ala, Met or Glu.

7. A (15-125)human interleukin-3 mutant polypeptide of
35 the Formula V:

Asn Cys Xaa Xaa

1 5 10

15

5

Xaa Xaa

20 Xaa Xaa Xaa Xaa Gln Gln [SEQ ID NO:19]
110

wherein

25 xaa at position 3 is Ser, Lys, Gly, Asp, Met, Gln, or Arg;
 xaa at position 4 is Asn, His, Leu, Ile, Phe, Arg, or Gln;
 xaa at position 5 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;
 xaa at position 6 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;
 xaa at position 7 is Asp, Phe, Lys, Arg, Ala, Gly, Glu, Gln, Asn,

30 Thr, Ser or Val;
 xaa at position 8 is Glu, Trp, Pro, Ser, Ala, His, Asp, Asn, Gln,
 Leu, Val, or Gly;
 xaa at position 9 is Ile, Val, Ala, Leu, Gly, Trp, Lys, Phe,
 Leu, Ser, or Arg;

35 xaa at position 10 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;
 xaa at position 11 is Thr, His, Gly, Gln, Arg, Pro, or Ala;
 xaa at position 12 is His, Thr, Phe, Gly, Arg, Ala, or Trp;

Xaa at position 13 is Leu, Gly, Arg, Thr, Ser, or Ala;
 Xaa at position 14 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;
 Xaa at position 15 is Gln, Asn, Leu, Pro, Arg, or Val;
 Xaa at position 16 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or
 5 Lys;
 Xaa at position 17 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;
 Xaa at position 18 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;
 Xaa at position 19 is Pro, Leu, Gln, Ala, Thr, or Glu;
 Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Glu, Gln, Thr,
 10 Arg, Ala, Phe, Ile or Met;
 Xaa at position 21 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;
 Xaa at position 22 is Asp, Leu, or Val;
 Xaa at position 23 is Phe, Ser, Pro, Trp, or Ile;
 Xaa at position 24 is Asn, or Ala;
 15 Xaa at position 26 is Leu, Trp, or Arg;
 Xaa at position 27 is Asn, Cys, Arg, Leu, His, Met, Pro;
 Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Lys, Asn, Thr, Leu,
 Val, Glu, Phe, Tyr, Ile or Met;
 Xaa at position 29 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala, Cys, Gln,
 20 Arg, Thr, Gly or Ser;
 Xaa at position 30 is Asp, Ser, Leu, Arg, Lys, Thr, Met, Trp, Glu,
 Asn, Gln, Ala or Pro;
 Xaa at position 31 is Gln, Pro, Phe, Val, Met, Leu, Thr, Lys, Asp,
 Asn, Arg, Ser, Ala, Ile, Glu, His or Trp;
 25 Xaa at position 32 is Asp, Phe, Ser, Thr, Cys, Glu, Asn, Gln,
 Lys, His, Ala, Tyr, Ile, Val or Gly;
 Xaa at position 33 is Ile, Gly, Val, Ser, Arg, Pro, or His;
 Xaa at position 34 is Leu, Ser, Cys, Arg, Ile, His, Phe, Glu,
 Lys, Thr, Ala, Met, Val or Asn;
 30 Xaa at position 35 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;
 Xaa at position 36 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn, Ser, Ala,
 Ile, Val, His, Phe, Met or Gln;
 Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;
 Xaa at position 38 is Asn, His, Arg, Leu, Gly, Ser, or Thr;
 35 Xaa at position 39 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser,
 Met, or;
 Xaa at position 40 is Arg, Asp, Ile, Ser, Val, Thr, Gln, Asn,

- Lys, His, Ala or Leu;
- Xaa at position 41 is Arg, Thr, Val, Ser, Leu, or Gly;
- Xaa at position 42 is Pro, Gly, Cys, Ser, Gln, Glu, Arg, His,
Thr, Ala, Tyr, Phe, Leu, Val or Lys;
- 5 Xaa at position 43 is Asn or Gly;
Xaa at position 44 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;
Xaa at position 45 is Glu Tyr, His, Leu, Pro, or Arg;
Xaa at position 46 is Ala, Ser, Pro, Tyr, Asn, or Thr;
Xaa at position 47 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;
- 10 Xaa at position 48 is Asn, His, Val, Arg, Pro, Thr, Asp, or Ile;
Xaa at position 49 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;
Xaa at position 50 is Ala, Asn, Pro, Ser, or Lys;
Xaa at position 51 is Val, Thr, Pro, His, Leu, Phe, or Ser;
Xaa at position 52 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;
- 15 Xaa at position 53 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or
His;
Xaa at position 54 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;
Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or
Leu;
- 20 Xaa at position 56 is Asn, Leu, Val, Trp, Pro, or Ala;
Xaa at position 57 is Ala, Met, Leu, Pro, Arg, Glu, Thr, Gln,
Trp, or Asn;
Xaa at position 58 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;
Xaa at position 59 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;
- 25 Xaa at position 60 is Ile, Met, Thr, Pro, Arg, Gly, Ala;
Xaa at position 61 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser,
Gln, or Leu;
Xaa at position 62 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or
Asp;
- 30 Xaa at position 63 is Ile, Ser, Arg, Thr, or Leu;
Xaa at position 64 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;
Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, or
Asp;
Xaa at position 66 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;
- 35 Xaa at position 67 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;
Xaa at position 68 is Leu, Gln, Lys, Trp, Arg, Asp, Glu, Asn,
His, Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

Xaa at position 69 is Pro, Ala, Thr, Trp, Arg, or Met;
Xaa at position 70 is Cys, Glu, Gly, Arg, Met, or Val;
Xaa at position 71 is Leu, Asn, Val, or Gln;
Xaa at position 72 is Pro, Cys, Arg, Ala, or Lys;
5 Xaa at position 73 is Leu, Ser, Trp, or Gly;
Xaa at position 74 is Ala, Lys, Arg, Val, or Trp;
Xaa at position 75 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or
Ser;
Xaa at position 76 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;
10 Xaa at position 77 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;
Xaa at position 78 is Pro, Phe, Arg, Ser, Lys, His, Ala, Gly, Ile
or Leu;
Xaa at position 79 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;
Xaa at position 80 is Arg, Ile, Ser, Glu, Leu, Val, Gln, Lys, His,
15 Ala or Pro;
Xaa at position 81 is His, Gln, Pro, Arg, Val, Leu, Gly, Thr, Asn,
Lys, Ser, Ala, Trp, Phe, Ile or Tyr;
Xaa at position 82 is Pro, Lys, Tyr, Gly, Ile, or Thr;
Xaa at position 83 is Ile, Val, Lys, Ala, or Asn;
20 Xaa at position 84 is His, Ile, Asn, Leu, Asp, Ala, Thr, Glu,
Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;
Xaa at position 85 is Ile, Leu, Arg, Asp, Val, Pro, Gln,
Gly, Ser, Phe, or His;
Xaa at position 86 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln,
25 Pro;
Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Val,
Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu or Gln;
Xaa at position 88 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;
Xaa at position 89 is Asp, or Ser;
30 Xaa at position 90 is Trp, Val, Cys, Tyr, Thr, Met, Pro, Leu,
Gln, Lys, Ala, Phe, or Gly;
Xaa at position 91 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr,
Leu, Lys, Ile, Asp, or His;
Xaa at position 92 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;
35 Xaa at position 94 is Arg, Lys, Asp, Leu, Thr, Ile, Gln,
His, Ser, Ala, or Pro;
Xaa at position 95 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;

Xaa at position 96 is Lys, Asn, Thr, Leu, Gln, Arg,
His, Glu, Ser, Ala or Trp;
Xaa at position 97 is Leu, Ile, Arg, Asp, or Met;
Xaa at position 98 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;
Xaa at position 99 is Phe, Ser, Cys, His, Gly, Trp, Tyr, Asp,
Lys, Leu, Ile, Val or Asn;
Xaa at position 100 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;
Xaa at position 101 is Leu, Asn, Val, Pro, Arg, Ala, His, Thr,
Trp, or Met;
Xaa at position 102 is Lys, Leu, Pro, Thr, Met, Asp, Val, Glu, Arg,
Trp, Ser,
Asn, His, Ala, Tyr, Phe, Gln, or Ile;
Xaa at position 103 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;
Xaa at position 104 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;
Xaa at position 105 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;
Xaa at position 106 is Asn, Ala, Pro, Leu, His, Val, or Gln;
Xaa at position 107 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or
Gly;
Xaa at position 108 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,
Ile, Tyr, or Cys;
Xaa at position 109 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

and which can additionally have Met- or Met-Ala- preceding the amino acid in position 1; and wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding native amino acids of (1-133) human interleukin-3; or a polypeptide having substantially the same structure and substantially the same biological activity.

30 8. A (15-125)human interleukin-3 mutant polypeptide of
the Formula VI:

Xaa Xaa Xaa Leu Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Leu Xaa

35 40 45

5 Xaa Xaa

50 55 60

Xaa Xaa Xaa Leu Xaa Xaa Xaa Xaa Xaa Cys Xaa Pro Xaa Xaa Xaa

65 70 75

10

Xaa Xaa Xaa Xaa Arg Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asp Xaa

80 85 90

Xaa Xaa Phe Xaa Xaa Lys Leu Xaa Phe Xaa Xaa Xaa Xaa Leu Xaa

15 95 100 105

Xaa Xaa Xaa Xaa Gln Gln [SEQ ID NO:20]

110

20 wherein ,

Xaa at position 3 is Ser, Gly, Asp, Met, or Gln;

Xaa at position 4 is Asn, His, Leu, Ile, Phe, Arg, or Gln;

Xaa at position 5 is Met, Phe, Ile, Arg, or Ala;

Xaa at position 6 is Ile or Pro;

25 Xaa at position 7 is Asp, or Glu;

Xaa at position 9 is Ile, Val, Ala, Leu, or Gly;

Xaa at position 10 is Ile, Val, Phe, or Leu;

Xaa at position 11 is Thr, His, Gly, Gln, Arg, Pro, or Ala;

Xaa at position 12 is His, Phe, Gly, Arg, or Ala;

30 Xaa at position 14 is Lys, Leu, Gln, Gly, Pro, or Val;

Xaa at position 15 is Gln, Asn, Leu, Arg, or Val;

Xaa at position 16 is Pro, His, Thr, Gly, or Gln;

Xaa at position 17 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;

Xaa at position 18 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;

35 Xaa at position 19 is Pro, Leu, Gln, Ala, or Glu;

Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Ala, Arg, Gln,

Glu, Ile, Phe, Thr or Met;

Xaa at position 21 is Leu, Ala, Asn, Pro, Gln, or Val;
Xaa at position 22 is Asp or Leu;
Xaa at position 23 is Phe, Ser, Pro, Trp, or Ile;
Xaa at position 24 is Asn or Ala;

5 Xaa at position 27 is Asn, Cys, Arg, His, Met, or Pro;
Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Asn, Ile, Leu,
Met, Tyr, or Arg;
Xaa at position 30 is Asp, or Glu;
Xaa at position 31 is Gln, Val, Met, Leu, Thr, Lys, Ala, Asn Glu,

10 Ser or Trp;
Xaa at position 32 is Asp, Phe, Ser, Thr, Cys, Ala, Asn, Gln,
Glu, His, Ile, Lys, Tyr, Val or Gly;
Xaa at position 33 is Ile, Val, or His;
Xaa at position 35 is Met, Asn, or Asp;

15 Xaa at position 36 is Glu, Thr, Ala, Asn, Ser or Asp;
Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;
Xaa at position 38 is Asn or Gly;
Xaa at position 39 is Leu, Met, or Phe;
Xaa at position 40 is Arg, Ala or Ser;

20 Xaa at position 41 is Arg, Thr, Val, Leu, or Gly;
Xaa at position 42 is Pro, Gly, Cys, Ser, Gln, Ala, Arg, Asn,
Glu, His, Leu, Thr, Val or Lys;
Xaa at position 45 is Glu, Tyr, His, Leu, or Arg;
Xaa at position 46 is Ala, Ser, Asn, or Thr;

25 Xaa at position 47 is Phe or Ser;
Xaa at position 48 is Asn, Val, Pro, Thr, or Ile;
Xaa at position 49 is Arg, Tyr, Lys, Ser, His, or Val;
Xaa at position 50 is Ala or Asn;
Xaa at position 51 is Val, Thr, Leu, or Ser;

30 Xaa at position 52 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;
Xaa at position 53 is Ser, Phe, Val, Gly, Asn, Ile, or His;
Xaa at position 54 is Leu, Val, Ile, Phe, or His;
Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, or Gly;
Xaa at position 56 is Asn or Pro;

35 Xaa at position 57 is Ala, Met, Pro, Arg, Glu, Thr, or Gln;
Xaa at position 58 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;
Xaa at position 59 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, Arg, or

Pro;

Xaa at position 60 is Ile or Met;

Xaa at position 61 is Glu, Gly, Asp, Ser, or Gln;

Xaa at position 62 is Ser, Val, Ala, Asn, Glu, Pro, Gly, or

5 Asp;

Xaa at position 63 is Ile, Ser, or Leu;

Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, or
Asp;

Xaa at position 66 is Asn, Val, Gly, Thr, Leu, Glu, or Arg;

10 Xaa at position 67 is Leu, or Val;

Xaa at position 68 is Leu, Gln, Trp, Arg, Asp, Ala, Asn, Glu,
His, Met, Phe, Ser, Thr, Tyr or Val;

Xaa at position 69 is Pro, Ala, Thr, Trp, or Met;

Xaa at position 71 is Leu or Val;

15 Xaa at position 73 is Leu or Ser;

Xaa at position 74 is Ala, Arg, or Trp;

Xaa at position 75 is Thr, Asp, Glu, His, Asn, or Ser;

Xaa at position 76 is Ala, Asp, or Met;

Xaa at position 77 is Ala, Pro, Ser, Thr, Phe, Leu, or Asp;

20 Xaa at position 78 is Pro or Ser;

Xaa at position 79 is Thr, Asp, Ser, Pro, Ala, Leu, or Arg;

Xaa at position 81 is His, Pro, Arg, Val, Leu, Gly, Asn, Ile, Phe,
Ser or Thr;

Xaa at position 82 is Pro or Tyr;

25 Xaa at position 83 is Ile, Val, or Ala;

Xaa at position 84 is His, Ile, Asn, Leu, Asp, Ala, Thr,
Arg, Gln, Glu, Lys, Met, Ser, Tyr, Val or Pro;

Xaa at position 85 is Ile, Leu, Val, or Phe;

Xaa at position 86 is Lys, Leu, His, Arg, Ile, Gln, Pro or

30 Ser;

Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Val,
Asn, Ile, Leu or Tyr;

Xaa at position 88 is Gly, Glu, Lys, or Ser;

Xaa at position 90 is Trp, Val, Tyr, Met, or Leu;

35 Xaa at position 91 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr,
Leu, Lys, Ile, Asp, or His;

Xaa at position 92 is Glu, Ser, Ala, or Gly;

Xaa at position 94 is Arg, Ala, Gln, Ser or Lys;
Xaa at position 95 is Arg, Thr, Glu, Leu, Ser, or Gly;
Xaa at position 98 is Thr, Val, Gln, Glu, His, or Ser;
Xaa at position 100 is Tyr or Trp;
5 Xaa at position 101 is Leu or Ala;
Xaa at position 102 is Lys, Thr, Met, Val, Trp, Ser, Leu,
Ala, Asn, Gln, His, Met, Phe, Tyr or Ile;
Xaa at position 103 is Thr, Ser, or Asn;
Xaa at position 105 is Glu, Ser, Pro, Leu, Thr, or Tyr;
10 Xaa at position 106 is Asn, Pro, Leu, His, Val, or Gln;
Xaa at position 107 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or
Gly;
Xaa at position 108 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,
Ile, Tyr, or Cys;
15 Xaa at position 109 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

and which can additionally have Met- or Met-Ala- preceding the
amino acid in position 1; and wherein from 4 to 44 of the amino
acids designated by Xaa are different from the corresponding amin
20 acids of native (1-133) human interleukin-3; or a polypeptide
having substantially the same structure and substantially the sam
biological activity.

9. A (15-125)human interleukin-3 mutant polypeptide

25 according to Claim 7 of the Formula VII:

Asn Cys Xaa Xaa Xaa Ile Xaa Glu Xaa Xaa Xaa Xaa Leu Lys Xaa

1 5 10 15

30 Xaa Xaa Xaa Xaa Xaa Asp Xaa Xaa Asn Leu Asn Xaa Glu Xaa

Xaa Xaa Ile Leu Met Xaa Xaa Asn Leu Xaa Xaa Xaa Asn Leu Glu

35 40 45

35

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa

50 55 60

Glu Xaa Xaa Leu Xaa Xaa Leu Xaa Xaa Cys Xaa Pro Xaa Xaa Thr
 65 70 75

5 Ala Xaa Pro Xaa Arg Xaa Xaa Xaa Xaa Xaa Xaa Gly Asp Xaa
 80 85 90

Xaa Xaa Phe Xaa Xaa Lys Leu Xaa Phe Xaa Xaa Xaa Xaa Leu Glu
 10 95 100 105

Xaa Xaa Xaa Xaa Gln Gln [SEQ ID NO:21]
 110

15 wherein

Xaa at position 3 is Ser, Gly, Asp, Met, or Gln;

Xaa at position 4 is Asn, His, or Ile;

Xaa at position 5 is Met or Ile;

Xaa at position 7 is Asp or Glu;

20 Xaa at position 9 is Ile, Ala, Leu, or Gly;

Xaa at position 10 is Ile, Val, or Leu;

Xaa at position 11 is Thr, His, Gln, or Ala;

Xaa at position 12 is His or Ala;

Xaa at position 15 is Gln, Asn, or Val;

25 Xaa at position 16 is Pro, Gly, or Gln;

Xaa at position 17 is Pro, Asp, Gly, or Gln;

Xaa at position 18 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;

Xaa at position 19 is Pro or Glu;

Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Ala, Arg,

30 Gln, Glu, Ile, Phe, Thr or Met;

Xaa at position 21 is Leu, Ala, Asn, Pro, Gln, or Val;

Xaa at position 23 is Phe, Ser, Pro, or Trp;

Xaa at position 24 is Asn or Ala;

Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Asn, Ile,

35 Leu, Met Tyr or Arg;

Xaa at position 30 is Asp or Glu;

Xaa at position 31 is Gln, Val, Met, Leu, Thr, Ala, Asn,

Glu, Ser or Lys;

Xaa at position 32 is Asp, Phe, Ser, Thr, Ala, Asn, Gln, Glu,
His, Ile, Lys, Tyr, Val or Cys;

Xaa at position 36 is Glu, Ala, Asn, Ser or Asp;

5 Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;
Xaa at position 40 is Arg or Ala;
Xaa at position 41 is Arg, Thr, Val, Leu, or Gly;
Xaa at position 42 is Pro, Gly, Ser, Gln, Ala, Arg, Asn, Glu, Leu,
Thr, Val or Lys;

10 Xaa at position 46 is Ala or Ser;
Xaa at position 48 is Asn, Pro, Thr, or Ile;
Xaa at position 49 is Arg or Lys;
Xaa at position 50 is Ala or Asn;
Xaa at position 51 is Val or Thr;
15 Xaa at position 52 is Lys or Arg;
Xaa at position 53 is Ser, Phe, or His;
Xaa at position 54 is Leu, Ile, Phe, or His;
Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, or Gly;
Xaa at position 57 is Ala, Pro, or Arg;

20 Xaa at position 58 is Ser, Glu, Arg, or Asp;
Xaa at position 59 is Ala or Leu;
Xaa at position 62 is Ser, Val, Ala, Asn, Glu, Pro, or Gly;
Xaa at position 63 is Ile or Leu;
Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, Gly, or

25 Asp;
Xaa at position 66 is Asn, Gly, Glu, or Arg;
Xaa at position 68 is Leu, Gln, Trp, Arg, Asp, Ala, Asn, Glu,
His, Ile, Met, Phe, Ser, Thr, Tyr or Val;

30 Xaa at position 69 is Pro or Thr;
Xaa at position 71 is Leu or Val;
Xaa at position 73 is Leu or Ser;
Xaa at position 74 is Ala or Trp;
Xaa at position 77 is Ala or Pro;
Xaa at position 79 is Thr, Asp, Ser, Pro, Ala, Leu, or Arg;
35 Xaa at position 81 is His, Pro, Arg, Val, Leu, Gly, Asn, Phe,
Ser or Thr;
Xaa at position 82 is Pro or Tyr;

Xaa at position 83 is Ile or Val;
Xaa at position 84 is His, Ile, Asn, Leu, Ala, Thr, Leu, Arg,
Gln, Leu, Lys, Met, Ser, Tyr, Val or Pro;
Xaa at position 85 is Ile, Leu, or Val;
5 Xaa at position 86 is Lys, Arg, Ile, Gln, Pro, or Ser;
Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Asn, Ile,
Leu or Tyr;
Xaa at position 90 is Trp or Leu;
Xaa at position 91 is Asn, Pro, Ala, Ser, Trp, Gln, Tyr, Leu,
10 Lys, Ile, Asp, or His;
Xaa at position 92 is Glu, or Gly;
Xaa at position 94 is Arg, Ala, or Ser;
Xaa at position 95 is Arg, Thr, Glu, Leu, or Ser;
Xaa at position 98 is Thr, Val, or Gln;
15 Xaa at position 100 is Tyr or Trp;
Xaa at position 101 is Leu or Ala;
Xaa at position 102 is Lys, Thr, Val, Trp, Ser, Ala, His,
Met, Phe, Tyr or Ile;
Xaa at position 103 is Thr or Ser;
20 Xaa at position 106 is Asn, Pro, Leu, His, Val, or Gln;
Xaa at position 107 is Ala, Ser, Ile, Asn, Pro, Asp, or Gly;
Xaa at position 108 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,
Ile, Tyr, or Cys;
Xaa at position 109 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;
25 which can additionally have Met- or Met-Ala- preceding the amino acid
in position 1; and wherein from 4 to 35 of the amino acids
designated by Xaa are different from the corresponding amino acids
of native human interleukin-3

30 10. A (15-125)human interleukin-3 mutant polypeptide
according to Claim 7 of the Formula VIII:

Xaa Pro Xaa Pro Xaa Xaa Asp Phe Xaa Asn Leu Asn Xaa Glu Asp

20 25

30

Xaa Xaa Ile Leu Met Xaa Xaa Asn Leu Arg Xaa Xaa Asn Leu Glu

35 40

45

5

Ala Phe Xaa Arg Xaa Xaa Lys Xaa Xaa Xaa Asn Ala Ser Ala Ile

50 55

60

Glu Xaa Xaa Leu Xaa Xaa Leu Xaa Pro Cys Leu Pro Xaa Xaa Thr

10

65 70

75

Ala Xaa Pro Xaa Arg Xaa Pro Ile Xaa Xaa Xaa Xaa Gly Asp Trp

80 85

90

15

Xaa Glu Phe Xaa Xaa Lys Leu Xaa Phe Tyr Leu Xaa Xaa Leu Glu

95 100

105

Xaa Xaa Xaa Xaa Gln Gln [SEQ ID NO:22]

110

20 wherein

Xaa at position 3 is Ser, Gly, Asp, or Gln;

Xaa at position 4 is Asn, His, or Ile;

Xaa at position 9 is Ile, Ala, Leu, or Gly;

Xaa at position 11 is Thr, His, or Gln;

25 Xaa at position 12 is His or Ala;

Xaa at position 15 is Gln or Asn;

Xaa at position 16 is Pro or Gly;

Xaa at position 18 is Leu, Arg, Asn, or Ala;

Xaa at position 20 is Leu, Val, Ser, Ala, Arg, Gln, Glu, Ile,

30 Phe, Thr or Met;

Xaa at position 21 is Leu, Ala, Asn, or Pro;

Xaa at position 24 is Asn or Ala;

Xaa at position 28 is Gly, Asp, Ser, Ala, Asn, Ile, Leu, Met,

Tyr or Arg;

35 Xaa at position 31 is Gln, Val, Met, Leu, Ala, Asn, Glu or Lys;

Xaa at position 32 is Asp, Phe, Ser, Ala, Gln, Glu, His, Val

or Thr;

Xaa at position 36 is Glu, Asn, Ser or Asp;
Xaa at position 37 is Asn, Arg, Pro, Thr, or His;
Xaa at position 41 is Arg, Leu, or Gly;
Xaa at position 42 is Pro, Gly, Ser, Ala, Asn, Val, Leu or Gln;
5 Xaa at position 48 is Asn, Pro, or Thr;
Xaa at position 50 is Ala or Asn;
Xaa at position 51 is Val or Thr;
Xaa at position 53 is Ser or Phe;
Xaa at position 54 is Leu or Phe;
10 Xaa at position 55 is Gln, Ala, Glu, or Arg;
Xaa at position 62 is Ser, Val, Asn, Pro, or Gly;
Xaa at position 63 is Ile or Leu;
Xaa at position 65 is Lys, Asn, Met, Arg, Ile, or Gly;
Xaa at position 66 is Asn, Gly, Glu, or Arg;
15 Xaa at position 68 is Leu, Gln, Trp, Arg, Asp, Asn, Glu, His,
Met, Phe, Ser, Thr, Tyr or Val;
Xaa at position 73 is Leu or Ser;
Xaa at position 74 is Ala or Trp;
Xaa at position 77 is Ala or Pro;
20 Xaa at position 79 is Thr, Asp, or Ala;
Xaa at position 81 is His, Pro, Arg, Val, Gly, Asn, Ser or Thr;
Xaa at position 84 is His, Ile, Asn, Ala, Thr, Arg, Gln, Glu,
Lys, Met, Ser, Tyr, Val or Leu;
Xaa at position 85 is Ile or Leu;
25 Xaa at position 86 is Lys or Arg;
Xaa at position 87 is Asp, Pro, Met, Lys, His, Pro, Asn, Ile, Leu
or Tyr;
Xaa at position 91 is Asn, Pro, Ser, Ile or Asp;
Xaa at position 94 is Arg, Ala, or Ser;
30 Xaa at position 95 is Arg, Thr, Glu, Leu, or Ser;
Xaa at position 98 is Thr or Gln;
Xaa at position 102 is Lys, Val, Trp, or Ile;
Xaa at position 103 is Thr, Ala, His, Phe, Tyr or Ser;
Xaa at position 106 is Asn, Pro, Leu, His, Val, or Gln;
35 Xaa at position 107 is Ala, Ser, Ile, Pro, or Asp;
Xaa at position 108 is Gln, Met, Trp, Phe, Pro, His, Ile, or Tyr;
Xaa at position 109 is Ala, Met, Glu, Ser, or Leu;

and which can additionally have Met- or Met-Ala- preceding the amino acid in position 1; and wherein from 4 to 26 of the amino acids designated by Xaa are different from the corresponding amino acids of native (1-133)human interleukin-3; or a polypeptide having substantially the same structure and substantially the same biological activity.

11. A (15-125) human interleukin-3 mutant polypeptide
10 of claim 7 wherein:

Xaa at position 17 is Ser, Lys, Asp, Met, Gln, or Arg;
Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;
Xaa at position 19 is Met, Arg, Gly, Ala, or Cys;
15 Xaa at position 20 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;
Xaa at position 21 is Asp, Phe, Lys, Arg, Ala, Gly, or Val;
Xaa at position 22 is Glu, Trp, Pro, Ser, Ala, His, or Gly;
Xaa at position 23 is Ile, Ala, Gly, Trp, Lys, Leu, Ser, or Arg;
Xaa at position 24 is Ile, Gly, Arg, or Ser;
20 Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;
Xaa at position 26 is His, Thr, Phe, Gly, Ala, or Trp;
Xaa at position 27 is Leu, Gly, Arg, Thr, Ser, or Ala;
Xaa at position 28 is Lys, Leu, Gln, Gly, Pro, Val or Trp;
Xaa at position 29 is Gln, Asn, Loh, Pro, Arg, or Val;
25 Xaa at position 30 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or
Lys;
Xaa at position 31 is Pro, Asp, Gly, Arg, Leu, or Gln;
Xaa at position 32 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;
Xaa at position 33 is Pro, Leu, Gln, Thr, or Glu;
30 Xaa at position 34 is Leu, Gly, Ser, or Lys;
Xaa at position 35 is Leu, Ala, Gly, Asn, Pro, or Gln;
Xaa at position 36 is Asp, Leu, or Val;
Xaa at position 37 is Phe, Ser, or Pro;
Xaa at position 38 is Asn, or Ala;
35 Xaa at position 40 is Leu, Trp, or Arg;
Xaa at position 41 is Asn, Cys, Arg, Leu, His, Met, Pro;
Xaa at position 42 is Gly, Asp, Ser, Cys, or Ala;

Xaa at position 42 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala, Cys, or Ser;

Xaa at position 44 is Asp, Ser, Leu, Arg, Lys, Thr, Met, Trp, or Pro;

5 Xaa at position 45 is Gln, Pro, Phe, Val, Met, Leu, Thr, Lys, or Trp;

Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, or Gly;

Xaa at position 47 is Ile, Gly, Ser, Arg, Pro, or His;

Xaa at position 48 is Leu, Ser, Cys, Arg, His, Phe, or Asn;

10 Xaa at position 49 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;

Xaa at position 50 is Glu, Leu, Thr, Asp, or Tyr;

Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;

Xaa at position 52 is Asn, His, Arg, Leu, Gly, Ser, or Thr;

Xaa at position 53 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser, or;

15 Xaa at position 54 is Arg, Asp, Ile, Ser, Val, Thr, Gln, or Leu;

Xaa at position 55 is Arg, Thr, Val, Ser, Leu, or Gly;

Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, or Lys;

Xaa at position 57 is Asn or Gly;

Xaa at position 58 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;

20 Xaa at position 59 is Glu Tyr, His, Leu, Pro, or Arg;

Xaa at position 60 is Ala, Ser, Tyr, Asn, or Thr;

Xaa at position 61 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;

Xaa at position 62 is Asn His, Val, Arg, Pro, Thr, or Ile;

Xaa at position 63 is Arg, Tyr, Trp, Ser, Pro, or Val;

25 Xaa at position 64 is Ala, Asn, Ser, or Lys;

Xaa at position 65 is Val, Thr, Pro, His, Leu, Phe, or Ser;

Xaa at position 66 is Lys, Ile, Val, Asn, Glu, or Ser;

Xaa at position 67 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or His;

30 Xaa at position 68 is Leu, Val, Trp, Ser, Thr, or His;

Xaa at position 69 is Gln, Ala, Pro, Thr, Arg, Trp, Gly, or Leu;

Xaa at position 70 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 71 is Ala, Met, Leu, Arg, Glu, Thr, Gln, Trp, or Asn;

35 Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

Xaa at position 74 is Ile, Thr, Pro, Arg, Gly, Ala;

Xaa at position 75 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser, or Leu;

Xaa at position 76 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or Asp;

5 Xaa at position 77 is Ile, Ser, Arg, or Thr;

Xaa at position 78 is Leu, Ala, Ser, Glu, Gly, or Arg;

Xaa at position 79 is Lys, Thr, Gly, Asn, Met, Ile, or Asp;

Xaa at position 80 is Asn, Trp, Val, Gly, Thr, Leu, or Arg;

10 Xaa at position 81 is Leu, Gln, Gly, Ala, Trp, Arg, or Lys;

Xaa at position 82 is Leu, Gln, Lys, Trp, Arg, or Asp;

Xaa at position 83 is Pro, Thr, Trp, Arg, or Met;

Xaa at position 84 is Cys, Glu, Gly, Arg, Met, or Val;

Xaa at position 85 is Leu, Asn, or Gln;

15 Xaa at position 86 is Pro, Cys, Arg, Ala, or Lys;

Xaa at position 87 is Leu, Ser, Trp, or Gly;

Xaa at position 88 is Ala, Lys, Arg, Val, or Trp;

Xaa at position 89 is Thr, Asp, Cys, Leu, Val, Glu, His, or Asn;

Xaa at position 90 is Ala, Ser, Asp, Ile, or Met;

20 Xaa at position 91 is Ala, Ser, Thr, Phe, Leu, Asp, or His;

Xaa at position 92 is Pro, Phe, Arg, Ser, Lys, His, or Leu;

Xaa at position 93 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;

Xaa at position 94 is Arg, Ile, Ser, Glu, Leu, Val, or Pro;

Xaa at position 95 is His, Gln, Pro, Val, Leu, Thr or Tyr;

25 Xaa at position 96 is Pro, Lys, Tyr, Gly, Ile, or Thr;

Xaa at position 97 is Ile, Lys, Ala, or Asn;

Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr, or Pro;

Xaa at position 99 is Ile, Arg, Asp, Pro, Gln, Gly, Phe, or His;

Xaa at position 100 is Lys, Tyr, Leu, His, Ile, Ser, Gln, or Pro;

30 Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val, Tyr, or Gln;

Xaa at position 102 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;

Xaa at position 103 is Asp, or Ser;

Xaa at position 104 is Trp, Val, Cys, Tyr, Thr, Met, Pro, Leu,

35 Gln, Lys, Ala, Phe, or Gly;

Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr, Leu, Lys, Ile, or His;

Xaa at position 106 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;
 Xaa at position 108 is Arg, Asp, Leu, Thr, Ile, or Pro;
 Xaa at position 109 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly.

5 12. The human interleukin-3 mutant polypeptide of claim

7:

wherein;

10 Xaa at position 28 is Gly, Asp, Ser, Ile, Leu, Met, Tyr, or Ala;
 Xaa at position 31 is Gln, Val, Met or Asn;
 Xaa at position 32 is Asp, Ser, Ala, Gln, His or Val;
 Xaa at position 36 is Glu or Asp;
 Xaa at position 37 is Asn, Pro or Thr;
 Xaa at position 48 is Asn or Pro;
 15 Xaa at position 62 is Ser, or Pro;
 Xaa at position 68 is Leu, Trp, Asp, Asn Glu, His, Phe, Ser or Tyr;
 Xaa at position 81 is His, Arg, Thr, Asn or Ser;
 Xaa at position 84 is His, Ile, Leu, Ala, Arg, Gln, Lys, Met, Ser,
 Tyr or Val;
 20 Xaa at position 86 is Lys or Arg;
 Xaa at position 87 is Asp, Pro, His, Asn, Ile or Leu;
 Xaa at position 91 is Asn, or Pro;
 Xaa at position 94 is Arg, Ala, or Ser;
 Xaa at position 102 is Lys, Val, Trp, Ala, His, Phe, or Tyr;
 25 Xaa at position 107 is Ala, or Ile;
 Xaa at position 108 is Gln, or Ile; and
 Xaa at position 109 is Ala, Met or Glu.

30 13. A polypeptide of the formula

	1	5	10
	(Met) _m -Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr		
	15	20	
	Ser Trp Val Asn Cys Ser Xaa Xaa Xaa Asp Glu Ile Ile		
35	25	30	35
	Xaa His Leu Lys Xaa Pro Pro Xaa Pro Xaa Leu Asp Xaa		
	40	45	50

Xaa Asn Leu Asn Xaa Glu Asp Xaa Asp Ile Leu Xaa Glu		
	55	60
Xaa Asn Leu Arg Xaa Xaa Asn Leu Xaa Xaa Phe Xaa Xaa		
	65	70
5 Ala Xaa Lys Xaa Leu Xaa Asn Ala Ser Xaa Ile Glu Xaa		
	80	85
Ile Leu Xaa Asn Leu Xaa Pro Cys Xaa Pro Xaa Xaa Thr		
	90	95
10 Ala Xaa Pro Xaa Arg Xaa Pro Ile Xaa Ile Xaa Xaa Gly		
	105	110
Asp Trp Xaa Glu Phe Arg Xaa Lys Leu Xaa Phe Tyr Leu		
	120	125
Xaa Xaa Leu Glu Xaa Ala Gln Xaa Gln Gln Thr Thr Leu		
	130	
15 Ser Leu Ala Ile Phe [SEQ ID NO:129]		

wherein m is 0 or 1; Xaa at position 18 is Asn or Ile; Xaa at position 19 is Met, Ala or Ile; Xaa at position 20 is Ile, Pro or Ile; Xaa at position 23 is Ile, Ala or Leu; Xaa at position 25 is Thr or His; Xaa at position 29 is Gln, Arg, Val or Ile; Xaa at position 32 is Leu, Ala, Asn or Arg; Xaa at position 34 is Leu or Ser; Xaa at position 37 is Phe, Pro, or Ser; Xaa at position 38 is Asn or Ala; Xaa at position 42 is Gly, Ala, Ser, Asp or Asn; Xaa at position 45 is Gln, Val, or Met; Xaa at position 46 is Asp or Ser; Xaa at position 49 is Met, Ile, Leu or Asp; Xaa at position 50 is Glu or Asp; Xaa at position 51 is Asn Arg or Ser; Xaa at position 55 is Arg, Leu, or Thr; Xaa at position 56 is Pro or Ser; Xaa at position 59 is Glu or Leu; Xaa at position 60 is Ala or Ser; Xaa at position 62 is Asn, Val or Pro; Xaa at position 63 is Arg or His; Xaa at position 65 is Val or Ser; Xaa at position 67 is Ser, Asn, His or Gln; Xaa at position 69 is Gln or Glu; Xaa at position 73 is Ala or Gly; Xaa at position 76 is Ser, Ala or Pro; Xaa at position 79 is Lys, Arg or Ser; Xaa at position 82 is Leu, Glu, Val or Trp; Xaa at position 85 is Leu or Val; Xaa at position 87 is Leu, Ser, Tyr; Xaa at position 88

is Ala or Trp; Xaa at position 91 is Ala or Pro; Xaa at position 93 is Pro or Ser; Xaa at position 95 is His or Thr; Xaa at position 98 is His, Ile, or Thr; Xaa at position 100 is Lys or Arg; Xaa at position 101 is Asp,
5 Ala or Met; Xaa at position 105 is Asn or Glu; Xaa at position 109 is Arg, Glu or Leu; Xaa at position 112 is Thr or Gln; Xaa at position 116 is Lys, Val, Trp or Ser; Xaa at position 117 is Thr or Ser; Xaa at position 120 is Asn, Gln, or His; Xaa at position 123 is Ala or Glu; with
10 the proviso that from four to forty-four of the amino acids designated by Xaa are different from the corresponding amino acids of native human interleukin-3; or a polypeptide having substantially the same structure and substantially the same biological activity.

15

14. A polypeptide according to Claim 13 wherein Xaa at position 18 is Ile; Xaa at position 19 is Ala, or Ile; Xaa at position 20 is Pro, or Leu; Xaa at position 23 is Ala, or Leu; Xaa at position 25 is His;
20 Xaa at position 29 is Arg, Val, or Ile; Xaa at position 32 is Ala, Asn or Arg; Xaa at position 34 is Ser; Xaa at position 37 is Pro or Ser; Xaa at position 38 is Ala; Xaa at position 42 is Ala, Ser, Asp, or Asn; and Xaa at position 45 is Val or Met; Xaa at position 46 is Ser.

25

15. A polypeptide according to Claim 13 wherein Xaa at position 49 is Ile, or Leu, or Asp; Xaa at position 50 is Asp; Xaa at position 51 is Arg or Ser; Xaa at position 55 is Leu or Thr; Xaa at position 56 is Ser;
30 Xaa at position 59 is Glu or Leu; Xaa at position 60 is Ala or Ser; Xaa at position 62 is Val, or Pro; Xaa at position 63 is His; Xaa at position 65 is Ser; Xaa at position 67 is Asn, or His, or Gln; and Xaa at position 69 is Glu.

35

16. A polypeptide according to Claim 13

wherein Xaa at position 73 is Gly; Xaa at position 76 is Ala, or Pro; Xaa at position 79 is Arg, or Ser; Xaa at position 82 is Gln or Val, or Trp; Xaa at position 85 is Val; Xaa at position 87 is Ser, or Tyr; Xaa at position 5 88 is Trp; Xaa at position 91 is Pro; Xaa at position 93 is Ser; Xaa at position 95 is Thr; Xaa at position 98 is Ile or Thr; Xaa at position 100 is Arg; Xaa at position 101 is Ala, or Met; and Xaa at position 105 is Glu.

17. A polypeptide according to Claim 13
wherein Xaa at position 109 is Glu, or Leu; Xaa at
position 112 is Gln; Xaa at position 116 is Val, or Trp,
or Ser; Xaa at position 117 is Ser; Xaa at position 120
5 is Glu or His; and Xaa at position 123 is Glu.

18. A polypeptide according to Claim 13
wherein Xaa at position 18 is Ile; Xaa at position 19 is
Ala, or Ile; Xaa at position 20 is Pro, or Leu; Xaa at
10 position 23 is Ala, or Leu; Xaa at position 25 is His;
Xaa at position 29 is Arg or Val, or Ile; Xaa at position
32 is Ala or Asn, or Arg; Xaa at position 34 is Ser; Xaa
at position 37 is Pro or Ser; Xaa at position 38 is Ala;
Xaa at position 42 is Ala or Ser, Asp or Asn; Xaa at
15 position 45 is Val or Met; Xaa at position 46 is Ser; Xaa
at position 49 is Ile, or Leu, or Asp; Xaa at position 50
is Asp; Xaa at position 51 is Arg, or Ser; Xaa at
position 55 is Leu or Thr; Xaa at position 56 is Ser; Xaa
at position 59 is Glu or Leu; Xaa at position 60 is Ala
20 or Ser; Xaa at position 62 is Val, or Pro; Xaa at
position 63 is His; Xaa at position 65 is Ser; Xaa at
position 67 is Asn, or His, or Gln; and Xaa at position
69 is Glu.

25 19. A polypeptide according to Claim 13
wherein Xaa at position 73 is Gly; Xaa at position 76 is
Ala, or Pro; Xaa at position 79 is Arg, or Ser; Xaa at
position 82 is Gln or Val, or Trp; Xaa at position 85 is
Val; Xaa at position 87 is Ser, or Tyr; Xaa at position
30 88 is Trp; Xaa at position 91 is Pro; Xaa at position 93
is Ser; Xaa at position 95 is Thr; Xaa at position 98 is
Ile or Thr; Xaa at position 100 is Arg; Xaa at position
101 is Ala, or Met; Xaa at position 105 is Glu; Xaa at
position 109 is Glu, or Leu; Xaa at position 112 is Gln;
35 Xaa at position 116 is Val, or Trp, or Ser; Xaa at
position 117 is Ser; Xaa at position 120 is Glu or His;
and Xaa at position 123 is Glu.

20. A polypeptide of the formula

	1	5	10
	(Met _m -Alan) _p -Asn Cys Ser Xaa Xaa Xaa Asp Glu Xaa Ile		
5	15	20	
	Xaa His Leu Lys Xaa Pro Pro Xaa Pro Xaa Leu Asp Xaa		
	25	30	35
	Xaa Asn Leu Asn Xaa Glu Asp Xaa Xaa Ile Leu Xaa Glu		
10	40	45	
	Xaa Asn Leu Arg Xaa Xaa Asn Leu Xaa Xaa Phe Xaa Xaa		
	50	55	60
	Ala Xaa Lys Xaa Leu Xaa Asn Ala Ser Xaa Ile Glu Xaa		
	65	70	75
15	Ile Leu Xaa Asn Xaa Xaa Pro Cys Xaa Pro Xaa Ala Thr		
	80	85	
	Ala Xaa Pro Xaa Arg Xaa Pro Ile Xaa Ile Xaa Xaa Gly		
	90	95	100
	Asp Trp Xaa Glu Phe Arg Xaa Lys Leu Xaa Phe Tyr Leu		
20	105	110	
	Xaa Xaa Leu Glu Xaa Ala Gln Xaa Gln Gln [SEQ ID NO:130]		

wherein m is 0 or 1; n is 0 or 1; p is 0 or 1; Xaa at position 4 is Asn or Ile; Xaa at position 5 is Met, Ala or Ile; Xaa at position 6 is Ile, Pro or Leu; Xaa at position 9 is Ile, Ala or Leu; Xaa at position 11 is Thr or His; Xaa at position 15 is Gln, Arg, Val or Ile; Xaa at position 18 is Leu, Ala, Asn or Arg; Xaa at position 20 is Leu or Ser; Xaa at position 23 is Phe, Pro, or Ser; Xaa at position 24 is Asn or Ala; Xaa at position 28 is Gly, Ala, Ser, Asp or Asn; Xaa at position 31 is Gln, Val, or Met; Xaa at position 32 is Asp or Ser; Xaa at position 35 is Met, Ile or Asp; Xaa at position 36 is Glu or Asp; Xaa at position 37 is Asn, Arg or Ser; Xaa at 35 position 41 is Arg, Leu, or Thr; Xaa at position 42 is Pro or Ser; Xaa at position 45 is Glu or Leu; Xaa at position 46 is Ala or Ser; Xaa at position 48 is Asn, Val

or Pro; Xaa at position 49 is Arg or His; Xaa at position 51 is Val or Ser; Xaa at position 53 is Ser, Asn, His or Gln; Xaa at position 55 is Gln or Glu; Xaa at position 59 is Ala or Gly; Xaa at position 62 is Ser, Ala or Pro; Xaa at position 65 is Lys, Arg or Ser; Xaa at position 67 is Leu, Glu, or Val; Xaa at position 68 is Leu, Glu, Val or Trp; Xaa at position 71 is Leu or Val; Xaa at position 73 is Leu, Ser or Tyr; Xaa at position 74 is Ala or Trp; Xaa at position 77 is Ala or Pro; Xaa at position 79 is Pro or Ser; Xaa at position 81 is His or Thr; Xaa at position 84 is His, Ile, or Thr; Xaa at position 86 is Lys or Arg; Xaa at position 87 is Asp, Ala or Met; Xaa at position 91 is Asn or Glu; Xaa at position 95 is Arg, Glu, Leu; Xaa at position 98 Thr or Gln; Xaa at position 102 is Lys, Val, Trp or Ser; Xaa at position 103 is Thr or Ser; Xaa at position 106 is Asn, Gln, or His; Xaa at position 109 is Ala or Glu; with the proviso that from four to forty-four of the amino acids designated by Xaa are different from the corresponding amino acids of native (15-20) human interleukin-3; or a polypeptide having substantially the same structure and substantially the same biological activity.

21. A polypeptide according to Claim 20
25 wherein Xaa at position 4 is Ile; Xaa at position 5 is Ala, or Ile; Xaa at position 6 is Pro, or Leu; Xaa at position 9 is Ala, or Leu; Xaa at position 11 is His; Xaa at position 15 is Arg or Val, or Ile; Xaa at position 18 is Ala or Asn, or Arg; Xaa at position 20 is Ser; Xaa at position 23 is Pro or Ser; Xaa at position 24 is Ala; Xaa at position 28 is Ala or Ser, or Asp, or Asn; Xaa at position 31 is Val or Met; and Xaa at position 32 is Ser.

22. A polypeptide according to Claim 20
35 wherein Xaa at position 35 is Ile, or Leu, or Asp; Xaa at position 36 is Asp; Xaa at position 37 is Arg, or Ser; Xaa at position 41 is Leu or Thr; Xaa at position 42 is

Ser; Xaa at position 45 is Glu or Leu; Xaa at position 46 is Ala or Ser; Xaa at position 48 is Val, or Pro; Xaa at position 49 is His; Xaa at position 51 is Ser; Xaa at position 53 is Asn, or His, or Gln; and Xaa at position 55 is Glu.

23. A polypeptide according to Claim 20
wherein Xaa at position 59 is Gly; Xaa at position 62 is
Ala, or Pro; Xaa at position 65 is Arg, or Ser; Xaa at
10 position 67 is Gln or Val; Xaa at position 68 is Glu, or
Val, or Trp; Xaa at position 71 is Val; Xaa at position
73 is Ser, or Tyr; Xaa at position 74 is Trp; Xaa at
position 77 is Pro; Xaa at position 79 is Ser; Xaa at
position 81 is Thr; Xaa at position 84 is Ile or Thr; Xaa
15 at position 86 is Arg; Xaa at position 87 is Ala, or Met;
and Xaa at position 91 is Glu.

24. A polypeptide according to Claim 20
wherein Xaa at position 95 is Glu, or Leu; Xaa at
20 position 98 ia Gln; Xaa at position 102 is Val, or Trp,
or Ser; Xaa at position 103 is Ser; Xaa at position 106
is Glu or His; and Xaa at position 109 is Glu.

25. A polypeptide according to Claim 20
wherein Xaa at position 4 is Ile; Xaa at position 5 is
Ala, or Ile; Xaa at position 6 is Pro, or Leu; Xaa at
position 9 is Ala, or Leu; Xaa at position 11 is His; Xaa
at position 15 is Arg or Val, or Ile; Xaa at position 18
is Ala or Asn, or Arg; Xaa at position 20 is Ser; Xaa at
30 position 23 is Pro or Ser; Xaa at position 24 is Ala; Xaa
at position 28 is Ala or Ser, or Asp, or Asn; Xaa at
position 31 is Val or Met; Xaa at position 32 is Ser; Xaa
at position 35 is Ile, or Leu, or Asp; Xaa at position 36
is Asp; Xaa at position 37 is Arg, or Ser; Xaa at
35 position 41 is Leu or Thr; Xaa at position 42 is Ser; Xaa
at position 45 is Glu or Leu; Xaa at position 46 is Ala
or Ser; Xaa at position 48 is Val, or Pro; Xaa at

position 49 is His; Xaa at position 51 is Ser; Xaa at position 53 is Asn, or His, or Gln; and Xaa at position 55 is Glu.

5 26. A polypeptide according to Claim 20 wherein Xaa at position 59 is Gly; Xaa at position 62 is Ala, or Pro; Xaa at position 65 is Arg, or Ser; Xaa at position 67 is Gln or Val; Xaa at position 68 is Glu, or Val, or Trp; Xaa at position 71 is Val; Xaa at position 73 is Ser, or Tyr; Xaa at position 74 is Trp; Xaa at position 77 is Pro; Xaa at position 79 is Ser; Xaa at position 81 is Thr; Xaa at position 84 is Ile or Thr; Xaa at position 86 is Arg; Xaa at position 87 is Ala, or Met; Xaa at position 91 is Glu; Xaa at position 95 is Glu, or Lue; Xaa at position 98 is Gln; Xaa at position 102 is Val, or Trp, or Ser; Xaa at position 103 is Ser; Xaa at position 106 is Glu or His; and Xaa at position 109 is Glu.

20 27. A polypeptide according to Claim 20 which is selected from

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu
Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
Ala .
25 Glu Asp Val Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn
Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala
Ser
Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro
30 Leu
Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp
Gly
Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys
Thr
35 Leu Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:66];

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu

Lys
 Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
 Glu
 Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn
 5 Leu
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
 Ala
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
 Ala
 10 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
 Asp
 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
 Leu
 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:67];
 15
 Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu
 Lys
 Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser
 Glu
 20 Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn
 Leu
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
 Ala
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
 25 Ala
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
 Asp
 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
 Leu
 30 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:68];

 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
 Lys
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 35 Glu
 Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn
 Leu

Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser
 Ala
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
 Ala
 5 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
 Asp
 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
 Leu
 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:69];
 10
 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
 Lys
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 Glu
 15 Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn
 Leu
 Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser
 Ala
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
 20 Ala
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
 Asp
 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
 Leu
 25 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:70];
 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
 Lys
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 30 Glu
 Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro Asn
 Leu
 Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala Ser
 Ala
 35 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
 Ala
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly

Asp

Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
Leu
Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:71];

5

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
Lys

Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu

10 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn
Leu

Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
Gly

Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro Ser
15 Ala

Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala Gly
Asp

Trp Gln Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
Leu

20 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:72];

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
Lys

Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
25 Glu

Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn
Leu

Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
Gly

30 Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro Ser
Ala

Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala Gly
Asp

Trp Gln Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr

35 Leu

Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:73];

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
 Lys
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 Glu
 5 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn
 Leu
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
 Ala
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
 10 Ala
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
 Asp
 Trp Asn Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr
 Leu
 15 Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:74];

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
 Lys
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 20 Glu
 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn
 Leu
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
 Ala
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
 25 Ala
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
 Asp
 Trp Asn Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Ser
 30 Leu
 Glu His Ala Gln Glu Gln Gln [SEQ ID NO:75];

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
 Lys
 35 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 Glu
 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn

Leu
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
 Gly
 Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro Ser
 5 Ala
 Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala Gly
 Asp
 Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr
 Leu
 10 Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:76];

 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
 Lys
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 15 Glu
 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn
 Leu
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
 Gly
 20 Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro Ser
 Ala
 Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala Gly
 Asp
 Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr
 25 Leu
 Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:77];

 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu
 Lys
 30 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 Glu
 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn
 Leu
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser
 35 Gly
 Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro Ser
 Ala

Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala Gly
Asp
Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Ser
Leu
5 Glu His Ala Gln Glu Gln Gln [SEQ ID NO:78];

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu
Lys
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
10 Glu
Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn
Leu
Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser
Ala
15 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
Ala
Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
Asp
Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
20 Leu
Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:79];

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu
Lys
25 Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
Glu
Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro Asn
Leu
Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala Ser
30 Ala
Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
Ala
Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
Asp
35 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
Leu
Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:80];

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu
Lys
Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser
5 Glu
Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn
Leu
Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser
Ala
10 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu
Ala
Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly
Asp
Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr
15 Leu
Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:81];

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
Leu
20 Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn
Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn
Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala
25 Ser
Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
Ser
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
Gly
30 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Thr
Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:82];

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
35 Leu
Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn
Gly

Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn
Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala
Ser
5 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro
Ser
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala
Gly
Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
10 Thr
Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:83];

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
Leu
15 Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn
Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn
Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala
20 Ser
Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro
Ser
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala
Gly
25 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Ser
Leu Glu His Ala Gln Glu Gln Gln [SEQ ID NO:84];

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
30 Leu
Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
Ala
Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn
35 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
Ser
Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro

Leu
Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp
Gly
Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys
5 Thr
Leu Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:85];

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu
10 Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn
Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn
Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala
15 Ser
Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro
Leu
Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp
Gly
20 Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys
Thr
Leu Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:86];

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
25 Leu
Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn
Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn
30 Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
Ser
Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro
Leu
Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp
35 Gly
Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys
Thr

Leu Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:87];

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu
5 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
Ala
Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn
Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
10 Ser
Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
Ser
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
Gly
15 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Thr
Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:88];

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
20 Leu
Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn
Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn
25 Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala
Ser
Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
Ser
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
30 Gly
Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Thr
Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:89];

35 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu
Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn

Ser
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
 Asn
 Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
 5 Ser
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
 Ser
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
 Gly
 10 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
 Thr
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:90];

 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
 15 Leu
 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
 Ala
 Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
 Asn
 20 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
 Ser
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro
 Ser
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala
 25 Gly
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
 Thr
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:91];

 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
 30 Leu
 Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn
 Ser
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
 35 Asn
 Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
 Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro
Ser
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala
Gly
5 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Thr
Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:92];

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
10 Leu
Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn
Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn
15 Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala
Ser
Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro
Ser
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala
20 Gly
Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Ser
Leu Glu His Ala Gln Glu Gln Gln [SEQ ID NO:93];

25 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu
Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn
Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
30 Asn
Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
Ser
Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro
Ser
35 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala
Gly
Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val

Ser
 Leu Glu His Ala Gln Glu Gln Gln [SEQ ID NO:94];

 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
 5 Leu
 Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn
 Ser
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
 Asn
 10 Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala
 Ser
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro
 Ser
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala
 15 Gly
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
 Thr
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:95]; and

 20 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
 Leu
 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
 Ala
 Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
 25 Asn
 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
 Ser
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro
 Ser
 30 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala
 Gly
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
 Ser
 Leu Glu His Ala Gln Glu Gln Gln [SEQ ID NO:96].
 35
 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
 Leu
 40 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn

Ala
 Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg Leu Ser
 Asn
 5 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
 Ser
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
 10 Ser
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
 Gly
 15 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
 Thr
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 296]
 20 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ala Ile His His
 Leu
 Lys Arg Pro Pro Ala Pro Ser Leu Asp Pro Asn Asn Leu Asn
 Asp
 25 Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
 Asn
 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
 30 Ser
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
 Ser
 35 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
 Gly
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
 Thr
 40 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 300]
 45 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
 Leu
 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
 Asp
 50 Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
 Asn
 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
 55 Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
Ser

5 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
Gly

Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Thr

10 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 301]

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu

15 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
Ala

Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg Leu Pro
20 Asn

Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
Ser

25 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
Ser

Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
Gly

30 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 308]

35 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu

40 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
Asp

Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn

45 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
50 Ser

Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
Gly

55 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val

Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 309]

5

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu10 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn
AspGlu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn15 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala
SerGly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
Ser

20

Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
Gly25 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 310]

30

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys
AsnCys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys Arg
Pro

35

Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala Glu Asp
ValAsp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn Leu Glu
Ser

40

Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser Gly Ile
GluAla Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro Ser Ala Thr
AlaAla Pro Ser Arg His Pro Ile Ile Ile Lys Ala Gly Asp Trp
Gln

50

Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr Leu Glu
Gln

Ala Gln Glu Gln Gln [SEQ ID NO.: 315]

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys
 Asn

5 Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys Arg
 Pro

Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser Glu Asp
 Met

10 Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro Asn Leu Leu
 Ala

Phe Val Arg Ala Val Lys His Leu Glu Asn Ala Ser Gly Ile
 15 Glu

Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro Ser Ala Thr
 Ala

Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala Gly Asp Trp
 20 Gln

Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr Leu Glu
 Gln

25 Ala Gln Glu Gln Gln [SEQ ID NO.: 316]

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Leu Ile His His
 Leu

30 Lys Ile Pro Pro Asn Pro Ser Leu Asp Ser Ala Asn Leu Asn
 Ser

Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
 35 Asn

Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala
 Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
 40 Ser

Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
 Gly

45 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
 Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 318]

50 28. A pharmaceutical composition for the
 treatment of hematopoietic cell deficiencies comprising a
 therapeutically effective amount of a mutant human

interleukin-3 polypeptide selected from the group consisting of a polypeptide of claim 1, a polypeptide of claim 2, a polypeptide of claim 3, a polypeptide of claim 4, a polypeptide of claim 5, a polypeptide of claim 6, a
5 polypeptide of claim 7, a polypeptide of claim 8, a polypeptide of claim 9, a polypeptide of claim 10, a polypeptide of claim 11, a polypeptide of claim 12, a polypeptide of claim 13, a polypeptide of claim 14, a polypeptide of claim 15, a polypeptide of claim 16, a
10 polypeptide of claim 17; a polypeptide of claim 18, a polypeptide of claim 19, a polypeptide of claim 20, a polypeptide of claim 21, a polypeptide of claim 22, a polypeptide of claim 23, a polypeptide of claim 24, a polypeptide of claim 25, a polypeptide of claim 26 and a
15 polypeptide of claim 27, and a pharmaceutically acceptable carrier.

29. A pharmaceutical composition according to
20 Claim 28 for the treatment of hematopoietic cell deficiencies comprising a therapeutically effective amount of a polypeptide having an amino acid sequence corresponding to SEQ ID NO:88 and a pharmaceutically acceptable carrier.

25

30. A pharmaceutical composition according to
Claim 28 for the treatment of hematopoietic cell deficiencies comprising a therapeutically effective amount of a polypeptide having an amino acid sequence
30 corresponding to SEQ ID NO:89 and a pharmaceutically acceptable carrier.

31. A pharmaceutical composition according to
Claim 28 for the treatment of hematopoietic cell deficiencies comprising a therapeutically effective amount of a polypeptide having an amino acid sequence corresponding to SEQ ID NO:90 and a pharmaceutically

acceptable carrier.

32. A pharmaceutical composition according to
Claim 28 for the treatment of hematopoietic cell
5 deficiencies comprising a therapeutically effective
amount of a polypeptide selected from the group
consisting of

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:66;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:67;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:68;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:69;

20

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:70;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:71;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:72;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:73;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:74;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:75;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:76;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:77;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:78;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:79;

30 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:80;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:81;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:82;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:83;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:84;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:85;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:86;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:87;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:91;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:92;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:93;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:94;

30 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:95;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:96;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:258;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:259;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:260;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:261;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:262;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:263;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:278;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:279;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:314;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:315;

30 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:316;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:264;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:265;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:266;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:267;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:268;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:269;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:270;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:271;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:272;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:273;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:274;

30 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:275;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:276;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:277;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:280;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:281;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:282;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:283;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:284;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:285;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:286;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:287;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:288;

30 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:289;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:299;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:300;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:301;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:302;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:303;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:304;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:305;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:306;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:307;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:308;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:309;

30 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:310;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:311;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:312;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:313;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:314;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:317;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:318;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:319;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:320;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:321;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:322;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:323;

30 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:324;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:325;

a polypeptide having an amino acid sequence corresponding to SEQ ID NO:326;

and a pharmaceutically acceptable carrier.

5

33. A method of stimulating the production of hematopoietic cells which comprises administering a therapeutically effective amount of a mutant human interleukin-3 polypeptide selected from the group consisting of a polypeptide of claim 1, a polypeptide of claim 2, a polypeptide of claim 3, a polypeptide of claim 4, a polypeptide of claim 5, a polypeptide of claim 6, a polypeptide of claim 7, a polypeptide of claim 8, a polypeptide of claim 9, a polypeptide of claim 10, a polypeptide of claim 11, a polypeptide of claim 12, a polypeptide of claim 13, a polypeptide of claim 14, a polypeptide of claim 15, a polypeptide of claim 16, a polypeptide of claim 17; a polypeptide of claim 18, a polypeptide of claim 19, a polypeptide of claim 20, a polypeptide of claim 21, a polypeptide of claim 22, a polypeptide of claim 23, a polypeptide of claim 24, a polypeptide of claim 25, a polypeptide of claim 26, a polypeptide of claim 27, to a patient in need of such treatment.

34. A method according to claim 33 of stimulating the production of hematopoietic cells which comprises administering a therapeutically effective amount of a polypeptide having an amino acid sequence corresponding to SEQ ID NO:88.

35. A method according to claim 33 of stimulating the production of hematopoietic cells which comprises administering a therapeutically effective amount of a polypeptide having an amino acid sequence corresponding to SEQ ID NO:89.

35 36. A method according to claim 33 of stimulating the production of hematopoietic cells which comprises administering a therapeutically effective

amount of a polypeptide having an amino acid sequence corresponding to SEQ ID NO:90.

37. A method according to claim 33 of
5 stimulating the production of hematopoietic cells which comprises administering a therapeutically effective amount of a polypeptide selected from the group consisting of
- 10 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:66;
- a polypeptide having an amino acid sequence corresponding to SEQ ID NO:67;
- 15 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:68;
- a polypeptide having an amino acid sequence corresponding to SEQ ID NO:69;
- 20 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:70;
- a polypeptide having an amino acid sequence corresponding to SEQ ID NO:71;
- 25 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:72;
- 30 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:73;
- 35 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:74;
- a polypeptide having an amino acid sequence corresponding to

SEQ ID NO:75;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:76;

5

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:77;

10

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:78;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:79;

15

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:80;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:81;

20

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:82;

25

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:83;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:84;

30

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:85;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:86;

35

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:87;

- a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:91;
- 5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:92;
- a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:93;
- 10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:94;
- a polypeptide having an amino acid sequence corresponding to
15 SEQ ID NO:95;
- a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:96;
- 20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:258;
- a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:259;
- 25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:260;
- a polypeptide having an amino acid sequence corresponding to
30 SEQ ID NO:261;
- a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:262;
- 35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:263;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:278;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:279;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:314;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:315;

a polypeptide having an amino acid sequence corresponding to
15 SEQ ID NO:316;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:264;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:265;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:266;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:267;

30 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:268;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:269;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:270;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:271;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:272;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:273;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:274;

a polypeptide having an amino acid sequence corresponding to
15 SEQ ID NO:275;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:276;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:277;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:280;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:281;

a polypeptide having an amino acid sequence corresponding to
30 SEQ ID NO:282;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:283;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:284;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:285;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:286;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:287;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:288;

a polypeptide having an amino acid sequence corresponding to
15 SEQ ID NO:289;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:299;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:300;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:301;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:302;

a polypeptide having an amino acid sequence corresponding to
30 SEQ ID NO:303;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:304;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:305;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:306;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:307;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:308;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:309;

a polypeptide having an amino acid sequence corresponding to
15 SEQ ID NO:310;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:311;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:312;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:313;

25 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:314;

a polypeptide having an amino acid sequence corresponding to
30 SEQ ID NO:317;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:318;

35 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:319;

a polypeptide having an amino acid sequence corresponding to SEQ ID NO:320;

5 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:321;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:322;

10 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:323;

15 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:324;

a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:325;

20 a polypeptide having an amino acid sequence corresponding to
SEQ ID NO:326;

to a patient in need of such treatment.

25 38. A recombinant DNA sequence comprising
vector DNA and a DNA that encodes a polypeptide selected from
the group consisting of a polypeptide of claim 1, a polypeptide of
claim 2, a polypeptide of claim 3, a polypeptide of claim 4, a
polypeptide of claim 5, a polypeptide of claim 6, a polypeptide of
claim 7, a polypeptide of claim 8, a polypeptide of claim 9, a
polypeptide of claim 10, a polypeptide of claim 11, a polypeptide
of claim 12, a polypeptide of claim 13, a polypeptide of claim 14,
a polypeptide of claim 15, a polypeptide of claim 16, a polypeptide
of claim 17; a polypeptide of claim 18, a polypeptide of claim 19,
30 a polypeptide of claim 20, a polypeptide of claim 21, a polypeptide
of claim 22, a polypeptide of claim 23, a polypeptide of claim 24,
a polypeptide of claim 25, a polypeptide of claim 26, or a

polypeptide of claim 27,.

39. A recombinant DNA sequence according to
Claim 38 comprising vector DNA and a DNA having a
5 nucleotide sequence corresponding to SEQ ID NO:97.

40. A recombinant DNA sequence according to
Claim 38 comprising vector DNA and a DNA having a
nucleotide sequence corresponding to SEQ ID NO:100 or
10 103.

41. A recombinant DNA sequence according to
Claim 38 comprising vector DNA and a DNA having a
nucleotide sequence corresponding to SEQ ID NO:161.
15

42. A recombinant DNA sequence according to
Claim 38 comprising vector DNA and a DNA selected from

20 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:98;

a DNA having a nucleotide sequence corresponding to SEQ ID
NO:99;

25 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:101;

a DNA having a nucleotide sequence corresponding to SEQ ID
NO:102;

30 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:104;

35 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:105;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:106;

a DNA having a nucleotide sequence corresponding to SEQ ID

5 NO:107;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:108;

10 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:109;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:110;

15 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:111;

a DNA having a nucleotide sequence corresponding to SEQ ID

20 NO:112;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:113;

25 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:114;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:115;

30 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:116;

a DNA having a nucleotide sequence corresponding to SEQ ID

35 NO:117;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:118;

5 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:119;

a DNA having a nucleotide sequence corresponding to SEQ ID
NO:120;

10 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:121;

a DNA having a nucleotide sequence corresponding to SEQ ID
NO:122;

15 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:123;

20 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:124;

a DNA having a nucleotide sequence corresponding to SEQ ID
NO:125;

25 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:126;

a DNA having a nucleotide sequence corresponding to SEQ ID
NO:127;

30 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:160;

a DNA having a nucleotide sequence corresponding to SEQ ID
NO:161;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:398;

- 5 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:399;
- a DNA having a nucleotide sequence corresponding to SEQ ID
NO:346;
- 10 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:347
- a DNA having a nucleotide sequence corresponding to SEQ ID
NO:303
- 15 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:404
- 20 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:405
- a DNA having a nucleotide sequence corresponding to SEQ ID
NO:332
- 25 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:333
- a DNA having a nucleotide sequence corresponding to SEQ ID
NO:334
- 30 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:335
- a DNA having a nucleotide sequence corresponding to SEQ ID
NO:336
- a DNA having a nucleotide sequence corresponding to SEQ ID

NO:337

a DNA having a nucleotide sequence corresponding to SEQ ID

5 NO:338

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:339

10 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:340

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:341

15 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:342

20 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:343

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:344

25 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:345

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:348

30 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:349

a DNA having a nucleotide sequence corresponding to SEQ ID

35 NO:350

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:352

a DNA having a nucleotide sequence corresponding to SEQ ID

5 NO:353

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:354

10 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:355

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:356

15 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:357

20 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:358

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:359

25 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:360

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:361

30 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:362

a DNA having a nucleotide sequence corresponding to SEQ ID

35 NO:363

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:364

a DNA having a nucleotide sequence corresponding to SEQ ID

5 NO:365

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:366

10 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:367

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:368

15 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:369

20 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:370

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:371

25 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:372

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:373

30 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:374

a DNA having a nucleotide sequence corresponding to SEQ ID

35 NO:375

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:376

a DNA having a nucleotide sequence corresponding to SEQ ID

5 NO:377

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:378

10 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:379

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:380

15 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:381

20 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:382

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:384

25 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:385

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:386

30 a DNA having a nucleotide sequence corresponding to SEQ ID

NO:387

a DNA having a nucleotide sequence corresponding to SEQ ID

35 NO:388

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:389

5 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:390

a DNA having a nucleotide sequence corresponding to SEQ ID
NO:391

10 a DNA having a nucleotide sequence corresponding to SEQ ID
NO:392

15 43. A host cell containing a recombinant DNA
sequence of claim 38 and capable of expressing the
encoded polypeptide.

20 44. A host cell of claim 43 containing a
recombinant DNA vector comprising vector DNA and a DNA
having a nucleotide sequence corresponding to SEQ ID
NO:97 and capable of expressing the encoded polypeptide.

25 45. A host cell of claim 43 containing a
recombinant DNA vector comprising vector DNA and a DNA
having a nucleotide sequence corresponding to SEQ ID
NO:100 or 103 and capable of expressing the encoded
polypeptide.

30 46. A host cell of claim 43 containing a
recombinant DNA vector comprising vector DNA and a DNA
having a nucleotide sequence corresponding to SEQ ID
NO:161 and capable of expressing the encoded polypeptide.

35 47. A method of producing a mutant human
interleukin-3 polypeptide comprising the steps of:

(a) culturing a host cell containing a recombinant

DNA sequence comprising vector DNA and a DNA sequence of Claim 38 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

5

(b) harvesting the polypeptide from the culture.

48. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide 10 comprising the steps of:

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:97 15 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

(b) harvesting the polypeptide from the culture.

20

49. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide comprising the steps of:

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:100 25 or 103 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

30

(b) harvesting the polypeptide from the culture.

50. A method according to Claim 47 of 35 producing a mutant human interleukin-3 polypeptide comprising the steps of:

- (a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:161 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and
- (b) harvesting the polypeptide from the culture.
- 10 51. A vector containing a gene having a DNA sequence selected from the group consisting of:
- a DNA having a nucleotide sequence corresponding to SEQ ID NO:97;
- 15 a DNA having a nucleotide sequence corresponding to SEQ ID NO:100;
- 20 a DNA having a nucleotide sequence corresponding to SEQ ID NO:103;
- a DNA having a nucleotide sequence corresponding to SEQ ID NO:160;
- 25 a DNA having a nucleotide sequence corresponding to SEQ ID NO:161;
- a DNA having a nucleotide sequence corresponding to SEQ ID NO:404;
- 30 a DNA having a nucleotide sequence corresponding to SEQ ID NO:405;
- 35 a DNA having a nucleotide sequence corresponding to SEQ ID NO:364;

a DNA having a nucleotide sequence corresponding to
SEQ ID NO:368;

5 a DNA having a nucleotide sequence corresponding to
SEQ ID NO:369;

a DNA having a nucleotide sequence corresponding to
SEQ ID NO:376;

10 a DNA having a nucleotide sequence corresponding to
SEQ ID NO:377;

15 a DNA having a nucleotide sequence corresponding to
SEQ ID NO:378;

a DNA having a nucleotide sequence corresponding to
SEQ ID NO:385;

20 52. A recombinant DNA vector comprising a promoter, a ribosome binding site, and a signal peptide directly linked to a DNA sequence encoding a polypeptide selected from the group consisting of

25 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:88;

30 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:89; and

a polypeptide having an amino acid sequence corresponding to SEQ ID NO:90;

35 said vector being capable of directing expression of said mutant human interleukin-3 polypeptide.

53. A recombinant DNA vector according to
Claim 51 wherein the promoter is AraBAD.

54. A recombinant DNA vector according to
5 Claim 51 wherein the ribosome binding site is g10-L.

55. A recombinant DNA vector according to
Claim 51 wherein the signal peptide is a lamB signal
peptide.

10

56. A recombinant DNA vector according to
Claim 51 wherein the signal peptide is the lamB signal
peptide depicted in Figure 8.

15

57. A recombinant DNA vector according to
Claim 51 wherein the promoter is AraBAD and the ribosome
binding site is g10-L.

20

58. A recombinant DNA vector according to
Claim 51 wherein the promoter is AraBAD, the ribosome
binding site is g10-L, and the signal peptide is a lamB
signal peptide.

25

59. A recombinant DNA vector according to
Claim 51 wherein the promoter is AraBAD, the ribosome
binding site is g10-L, and the signal peptide is the lamB
signal peptide depicted in Figure 8.

30

60. A recombinant bacterial host which
comprises the vector of Claim 51 wherein said host
secretes a mutant human interleukin-3 polypeptide
selected from the group consisting of

35

a polypeptide having an amino acid sequence
corresponding to SEQ ID NO:88;

a polypeptide having an amino acid sequence

corresponding to SEQ ID NO:89; and

a polypeptide having an amino acid sequence corresponding to SEQ ID NO:90.

5

61. A polypeptide of the formula

1	5	10
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(Met)_m-Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr

10

15	20
----	----

Ser Trp Val Asn Cys Ser Xaa Met Ile Asp Glu Ile Ile

25	30	35
----	----	----

Xaa His Leu Lys Xaa Pro Pro Xaa Pro Leu Leu Asp Xaa

40	45	50
----	----	----

15 Asn Asn Leu Asn Xaa Glu Asp Xaa Asp Ile Leu Met Glu
 55 60

Xaa Asn Leu Arg Xaa Pro Asn Leu Xaa Xaa Phe Xaa Arg
 65 75

Ala Val Lys Xaa Leu Xaa Asn Ala Ser Xaa Ile Glu Xaa

20 85

Ile Leu Xaa Asn Leu Xaa Pro Cys Leu Pro Xaa Ala Thr
 90 100

Ala Ala Pro Xaa Arg His Pro Ile Xaa Ile Lys Xaa Gly
 105 115

25 Asp Trp Xaa Glu Phe Arg Xaa Lys Leu Thr Phe Tyr Leu
 120 125

Xaa Thr Leu Glu Xaa Ala Gln Xaa Gln Gln Thr Thr Leu
 130

Ser Leu Ala Ile Phe [SEQ ID NO:129]

30

wherein m is 0 or 1; Xaa at position 18 is Asn or Ile;
 Xaa at position 25 is Thr or His; Xaa at position 29 is
 Gln, Arg, or Val; Xaa at position 32 is Leu, Ala, or Asn;
 Xaa at position 37 is Phe, Pro, or Ser; Xaa at position
 35 42 is Glu, Ala, or Ser; Xaa at position 45 is Gln, Val,
 or Met; Xaa at position 51 is Asn or Arg; Xaa at position
 55 is Arg, Leu, or Thr; Xaa at position 59 is Glu or Leu;

Xaa at position 60 is Ala or Ser; Xaa at position 62 is Asn or Val; Xaa at position 67 is Ser, Asn, or His; Xaa at position 69 is Gln or Glu; Xaa at position 73 is Ala or Gly; Xaa at position 76 is Ser or Ala; Xaa at position 79 is Lys or Arg; Xaa at position 82 is Leu, Glu, or Val; Xaa at position 87 is Leu or Ser; Xaa at position 93 is Pro or Ser; Xaa at position 98 is His, Ile, or Thr; Xaa at position 101 is Asp or Ala; Xaa at position 105 is Asn or Glu; Xaa at position 109 is Arg or Glu; Xaa at position 116 is Lys or Val; Xaa at position 120 is Asn, Gln, or His; Xaa at position 123 is Ala or Glu; with the proviso that from four to twenty-seven of the amino acids designated by Xaa are different from the corresponding amino acids of native human interleukin-3 and wherein from 1 to 14 of amino acids 1 to 14 has been deleted from the N-terminus and/or from 1 to 15 of amino acids 119 to 133 has been deleted from the C-terminus of the polypeptide; or a polypeptide having substantially the same structure and substantially the same biological activity.

62. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide comprising the steps of:

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:160 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

(b) harvesting the polypeptide from the culture.

63. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide comprising the steps of:

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:161 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

(b) harvesting the polypeptide from the culture.

10

64. A host cell containing a recombinant DNA vector comprising vector DNA and a DNA sequence selected from the group consisting of:

15

a DNA having a nucleotide sequence corresponding to SEQ ID NO:160; and

a DNA having a nucleotide sequence corresponding to SEQ ID NO:161;

20

and capable of expressing the encoded polypeptide.

65. A polypeptide according to Claim 27 which is:

25 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu

Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn
Ser

30 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn

Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala
Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro
Ser

35 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala
Gly

Asp Trp Gln Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val
Thr

362 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:89].

363 1.01073213.3 0.921207

1 ATG Met	5 GCT Ala	10 CCA Pro	15 ATG Met	20 ACT Thr	25 CAG Gln	ACT Thr	TCT Ser	AAG Leu	ACT Lys	TCT Thr	
-----------------	-----------------	------------------	------------------	------------------	------------------	------------	------------	------------	------------	------------	--

15 TGG Trp	20 GTT Val	25 AAC Asn	TGC Cys	ATC Ser	GAT Asn	GAA Met	ATT Ile	ATA Asp	ACA Glu	AAC Ile	25 Thr
------------------	------------------	------------------	------------	------------	------------	------------	------------	------------	------------	------------	-----------

30 CAC His	35 TTA Leu	35 AAG Lys	CCA Gln	CCT Pro	TTG Pro	CCT Leu	TTG Leu	CTG Leu	GAC Asp	TTC Phe	AAC Asn
------------------	------------------	------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

40 AAC Asn	45 CTC Leu	45 AAT Asn	GGG Gly	GAA Glu	GAC Asp	CAA Gln	GAC Asp	ATT Ile	CTG Leu	ATG Met	GAA Glu	AAT Asn
------------------	------------------	------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

55 AAC Asn	60 CTT Leu	60 CGA Arg	AGG Arg	CCA Pro	AAC Asn	CTG Leu	GAG Glu	GCA Ala	TTC Phe	AAC Asn	AGG Arg	GCT Ala
------------------	------------------	------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

65 GTC Val	70 AAG Lys	70 AGT Ser	TTA Leu	CAG Gln	AAT Asn	GCA Ala	TCA Ser	GCA Ala	ATT Ile	GAG Glu	AGC Ser	ATT Ile
------------------	------------------	------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

80 CTT Leu	85 AAA Lys	85 AAT Asn	CTC Leu	CTG Leu	CCA Pro	TGT Cys	CTG Leu	CCC Pro	CTG Leu	GCC Leu	ACG Ala	GCC Thr
------------------	------------------	------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

95 GCA Ala	95 CCC Pro	100 ACG Thr	CGA Arg	CAT His	CCA Ile	ATC His	CAT Ile	ATC Lys	AAG Asp	GAC Gly	GGT Asp	GAC Asp
------------------	------------------	-------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

105 TGG Trp	110 AAT Asn	110 GAA Glu	115 TTC Phe	CGT Arg	CGT Arg	AAA Lys	CTG Leu	ACC Thr	TTC Phe	TAT Tyr	CTG Leu	AAA Lys
-------------------	-------------------	-------------------	-------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

120 ACC Thr	125 TTG Leu	125 GAG Glu	AAC Asn	GCG Ala	CAG Gln	GCT Gln	CAA Gln	CAG Gln	ACC Thr	ACT Thr	CTG Leu	TCG Ser
-------------------	-------------------	-------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

130 CTA Leu	[SEQ ID NO:144] Ala											
[SEQ ID NO:128] Ile												

FIG. 1

C
 1
 a
 I
 ATCGATGAAATCATACCCACCTGAAGCAGGCCACCGCTGCCGGCTGCTGGACTTCAACAAAC
 aa20 1 -----+-----+-----+-----+-----+-----+-----+-----+
 IleAspGluIleThrHisLeuLysGlnProProLeuProLeuAspPheAsnAsn -
 E
 X
 h
 o
 R
 V
 CTCAAATGGTGAAGACCAAGATATCCTGATGGAAAATAACCTTCGTCGTCACCTCGAG
 61 -----+-----+-----+-----+-----+-----+-----+-----+
 LeuAsnGlyGluAspGlnAspIleLeuMetGluAsnAsnLeuArgArgProAsnLeuGlu -
 P
 S
 t
 I
 N
 S
 i
 I
 GCATTCAACCGGTGCTGTCAGTCTCTGCAGAATGCAT [SEQ ID NO: 145] aa70
 121 -----+-----+-----+-----+-----+-----+-----+
 AlaPheAsnArgAlaValLyssSerLeuGlnAsnAla [SEQ ID NO: 146]

FIG. 2: Clai to NsII Replacement Fragment

FIG. 2

N H
 C P
 O a
 I I
 1 CCATGGCTCCAATGACTCAGACTACTTCTCTTAAGACTTCTGGGTTAACTGCTCTAACCA
 GGTACCGAGGTTACTGAGTCTGATGAAGAGAATTCTGAAGAACCCATTGACGAGATTGT 60
 Met Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr Ser Trp Val Asn Cys Ser Asn Met

 C
 l
 a
 I
 61 TGATCGATGAAATTATAACACACTTAAAGCAGCCACCTTGCCCTTGCTGGACTTCACCA
 ACTAGCTACTTTAATATTGTGTGAATTCTCGTCGGTGGAAACGGAAACGACCTGAAGTTGT 120
 Ile Asp Glu Ile Ile Thr His Leu Lys Gln Pro Pro Leu Pro Leu Asp Phe Asn Asn

 ACCTCAATGGGGAAAGACCAAGACATTCTGATGGAAAATAACCTCGAAGGCCAACCTGG
 121 TGGAGTTACCCCTTCTGGTTCTGTAAGACTACCTTTATTGGAAGCTTCCGGTTGGACC 180
 Leu Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn Leu Glu

 N
 S
 i
 I
 181 AGGCATTCAACAGGGCTGTCAAGAGTTACAGAATGCATCAGCAATTGAGAGCATTCTTA
 TCCGTAAGTTGTCCCACAGTTCTCAAATGTCTACGTAGTCGTTAACTCTCGTAAGAAT 240
 Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys

 AAAATCTCCTGCCATGTCTGCCCTGGCCACGGCCGCACCCACGCGACATCCAATCCATA
 241 TTTTAGAGGACGGTACAGACGGGGACCGGTGCCGGTGGGTGCGCTGTAGGTTAGGTAT 300
 Asn Leu Leu Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile

FIG. 3A

E
C
O
R
I

301 TCAAGGACGGTACTGGAATGAATTCCGTCAAACGTACCTCTATCTGAAAACCTTGG
-----+-----+-----+-----+-----+-----+-----+ 360
AGTTCCCTGCCACTGACCTTACTTAAGGCAGCATTGACTGGAAGATAGACTTTGGAACC

LysAspGlyAspTrpAsnGluPheArgArgLysLeuThrPheTyrLeuLysThrLeuGlu

H
i
n
d
I
I
I

N
h
e
I

361 AGAACGCGCAGGCTAACACAGACCACTCTGTCGCTAGCGATCTTTAATAAGCTT
-----+-----+-----+-----+-----+-----+-----+ 414
TCTTGCCTGCCAGTTGTCTGGTGAGACAGCGATCGCTAGAAAATTATTCGAA

AsnAlaGlnAlaGlnGlnThrThrLeuSerLeuAlaIlePheEndEnd

FIG. 3B

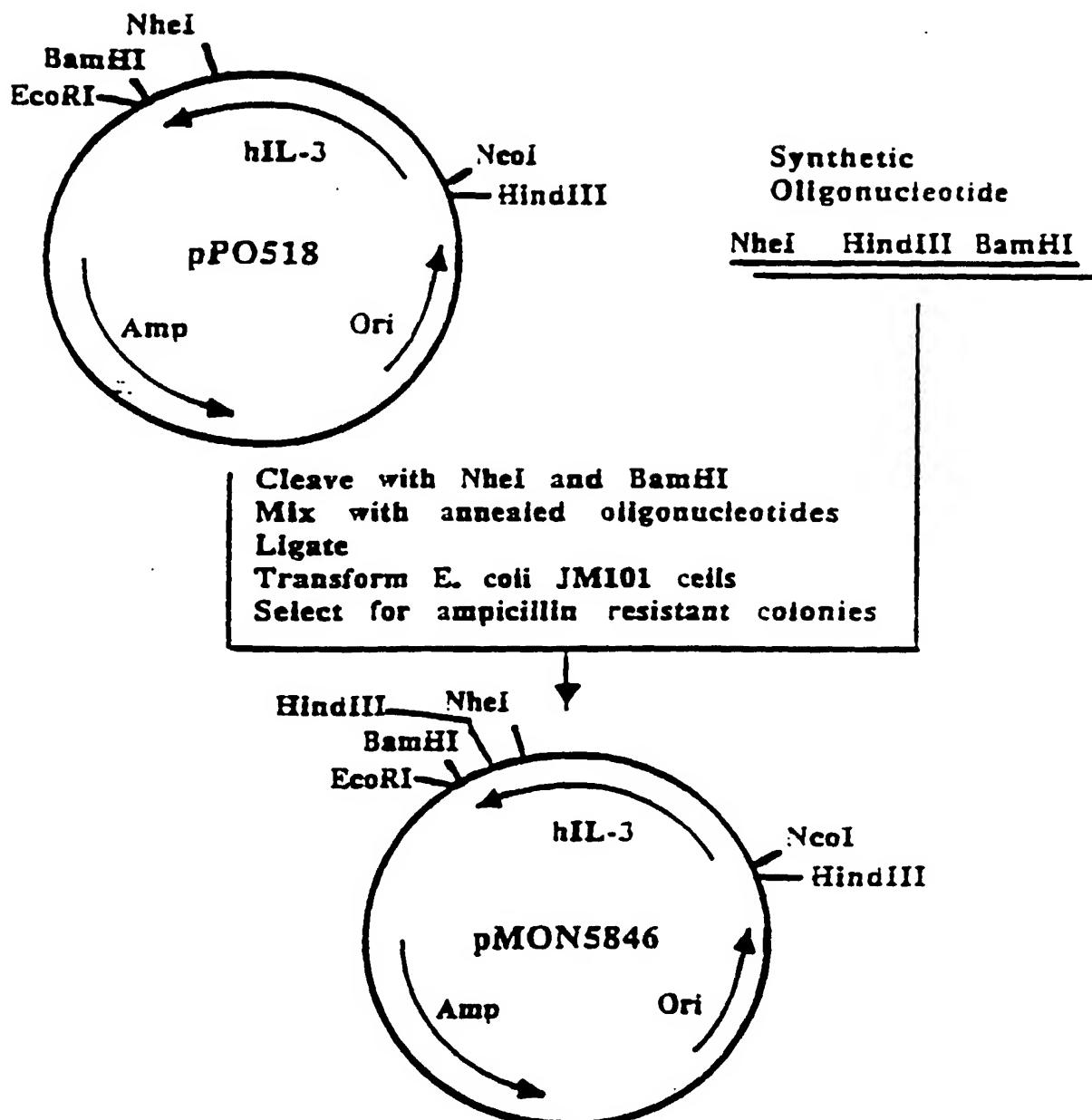


FIG. 4

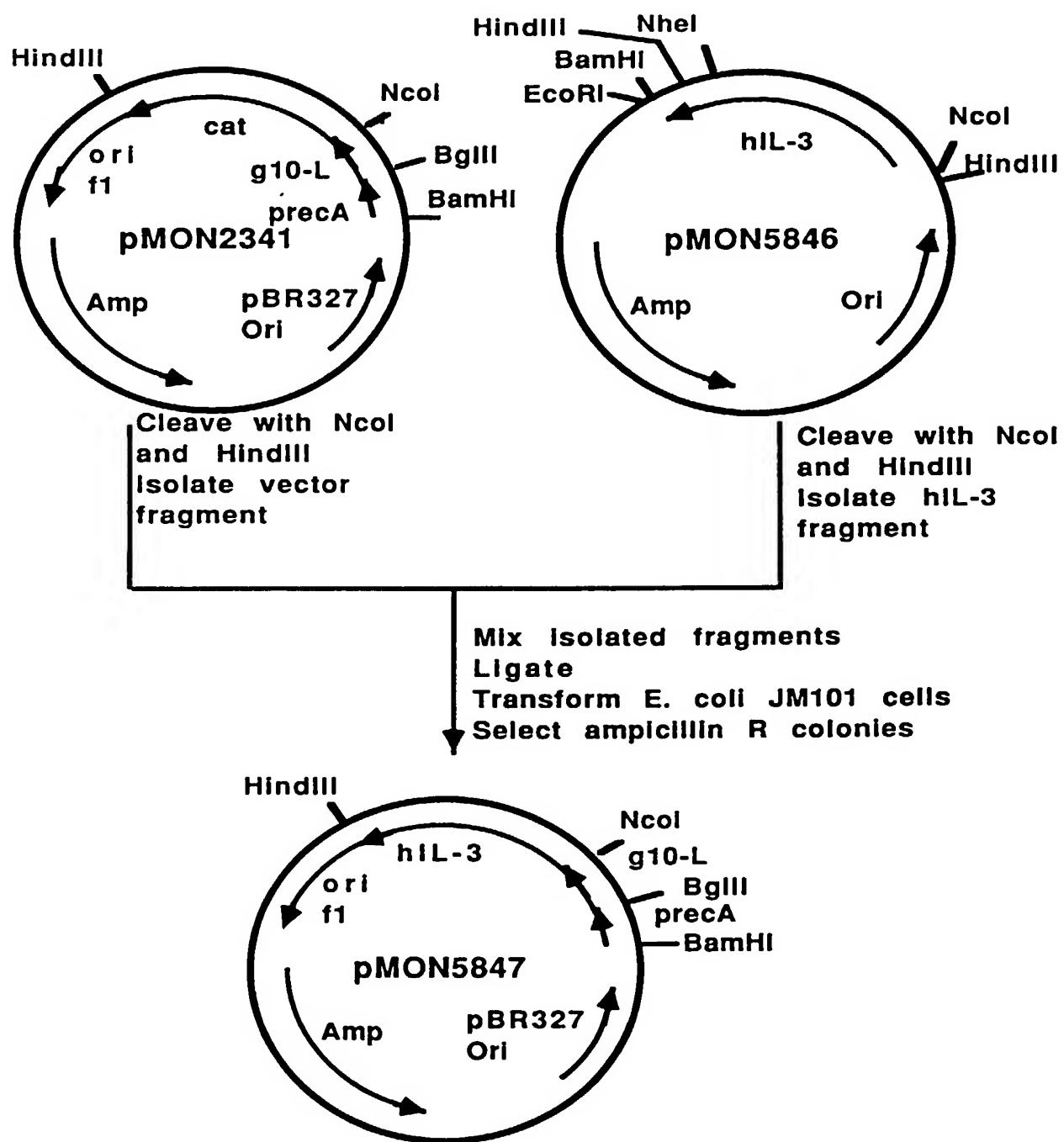
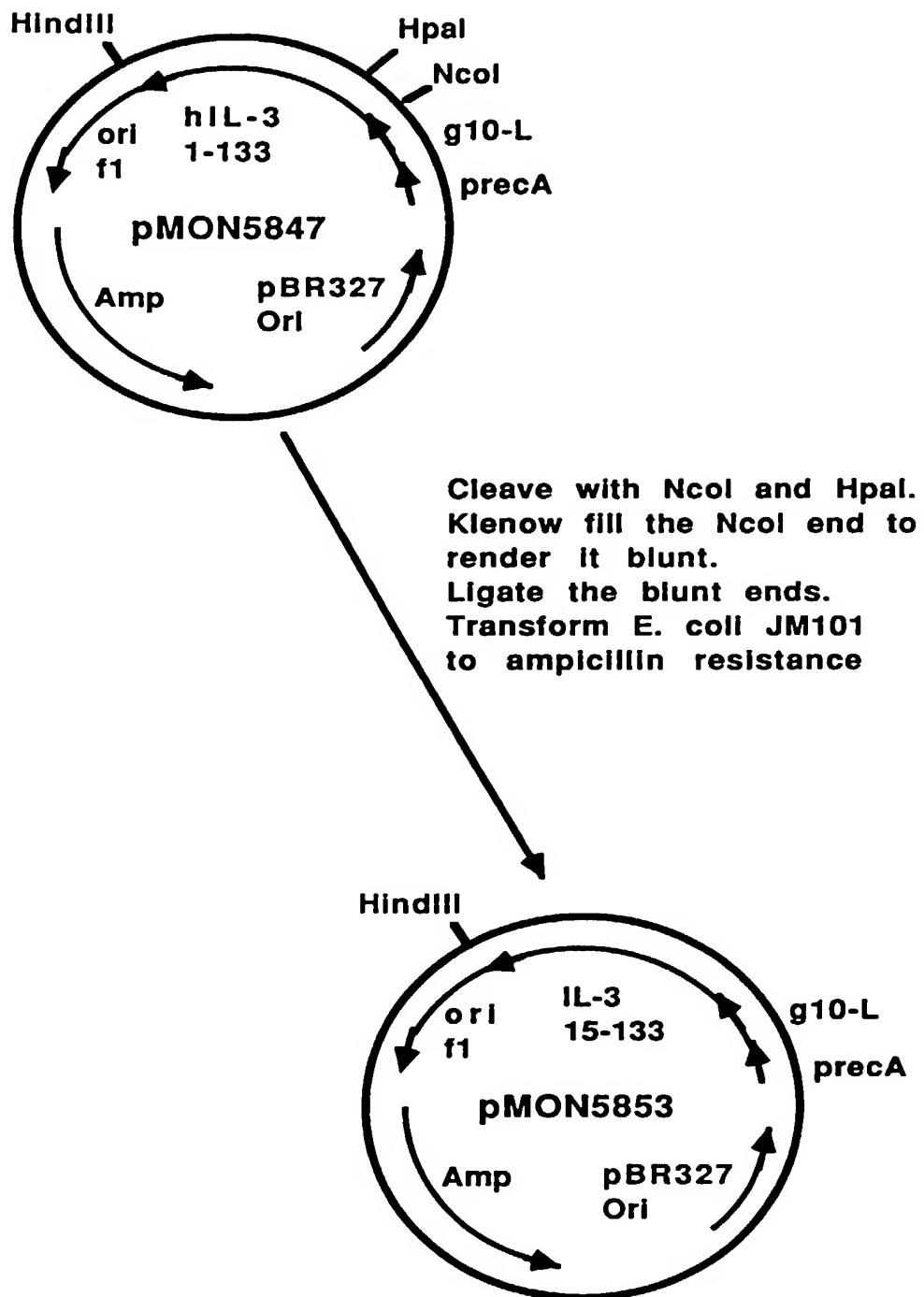


FIG. 5

**FIG. 6**

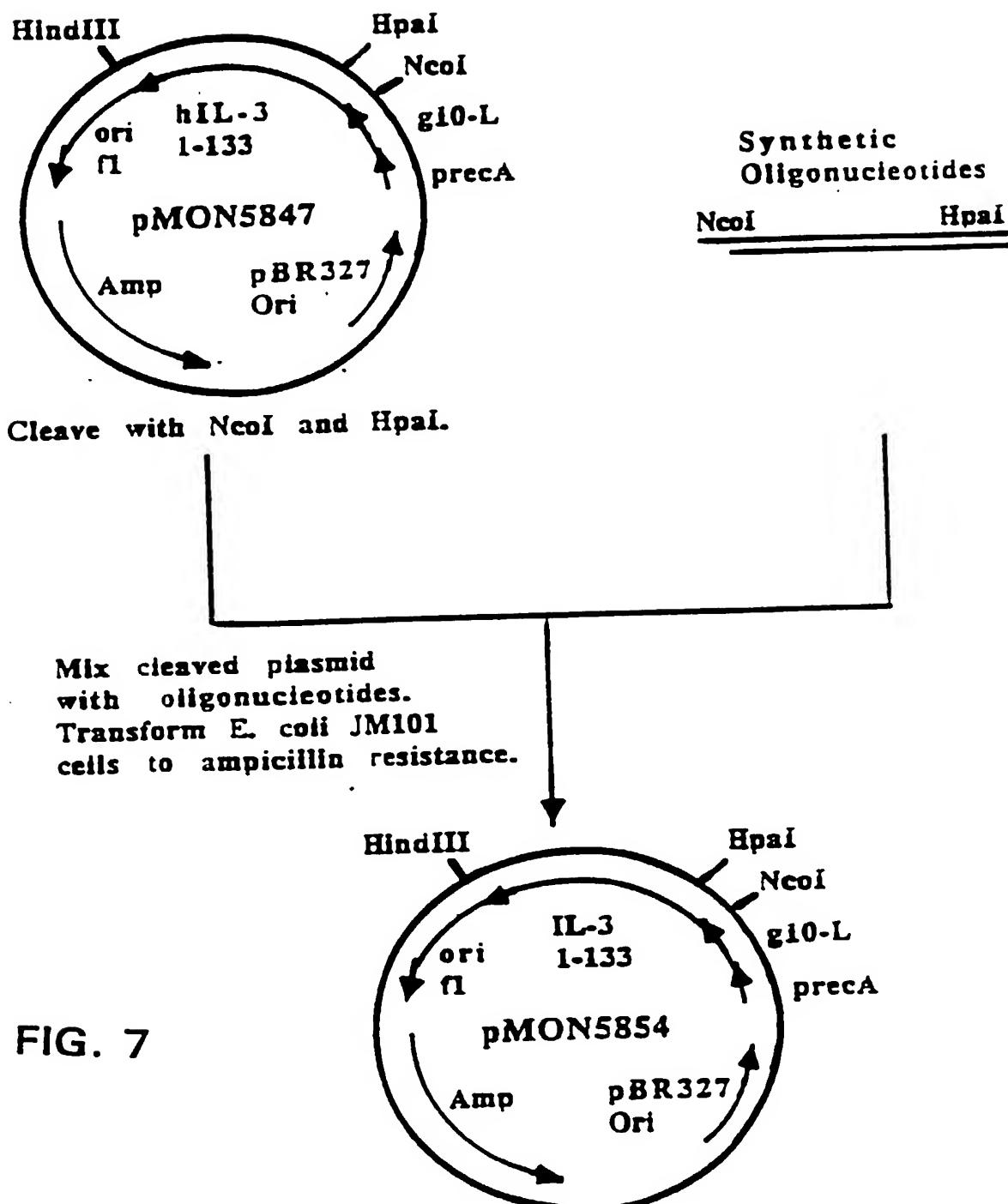


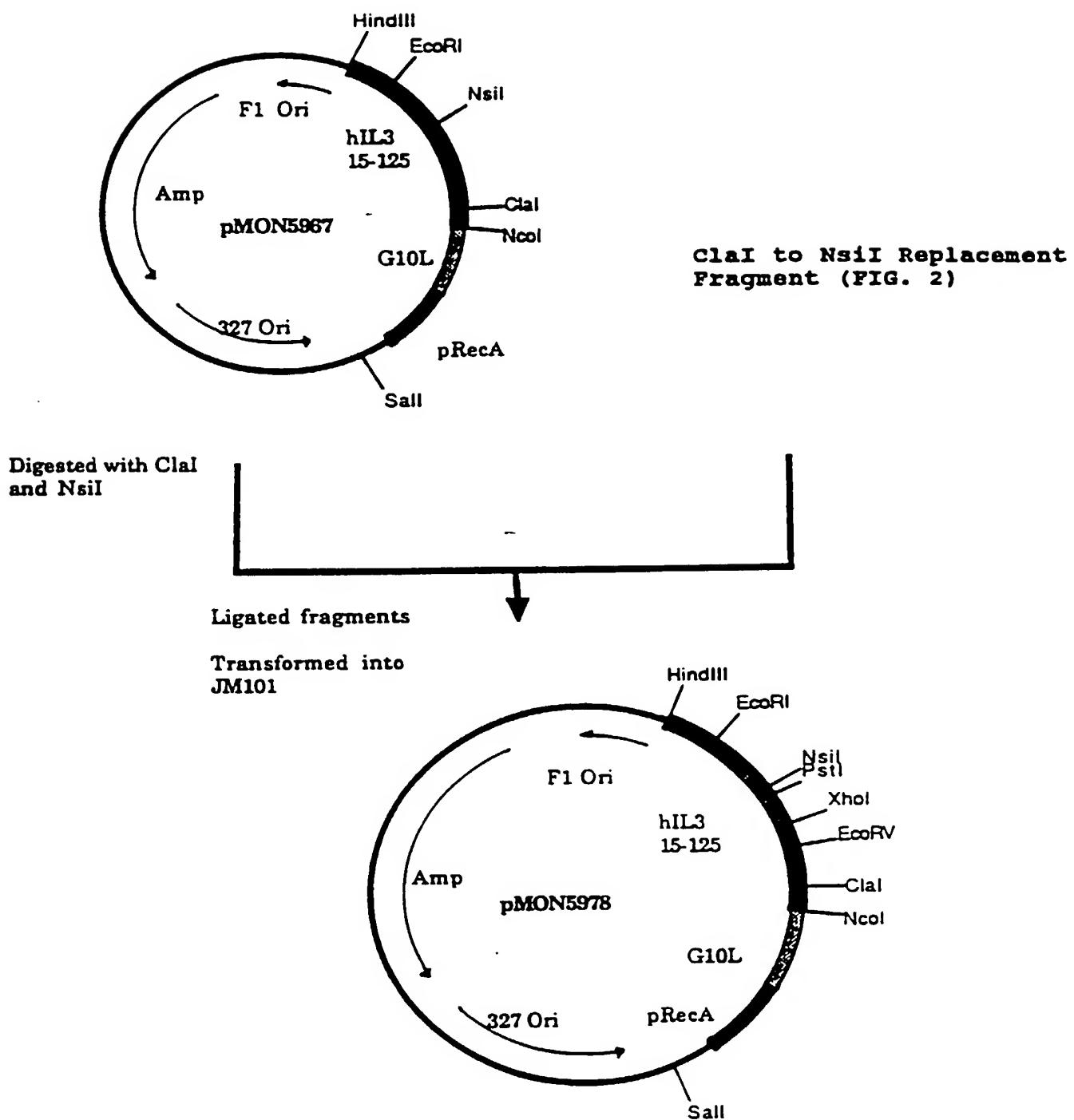
FIG. 7

ATGATGATTACTCTGC₁CGCAA₂CTTC₃CTGGCGGTTGCCGTCG₄CAGCGGGCGTAATGTCT
TACTACTAATGAGACGCGTTGAAGGAGACCGCCA₅ACGGCAGCGTCGCCCGCATTACAGA₆₀
MetMetIleThrLeuArgLysLeuProLeuAlaValAlaValAlaAlaGlyValMetSer

N
C
O
I
61 GCTCAGGCCATGGCTAACTGC [SEQ ID NO: 149]
CGAGTCCGGTACCGATTGACG [SEQ ID NO: 150]
AlaGlnAlaMetAlaAsnCys [SEQ ID NO: 14]
 ↑

lamB Signal Peptide

FIG. 8

**FIG. 9**

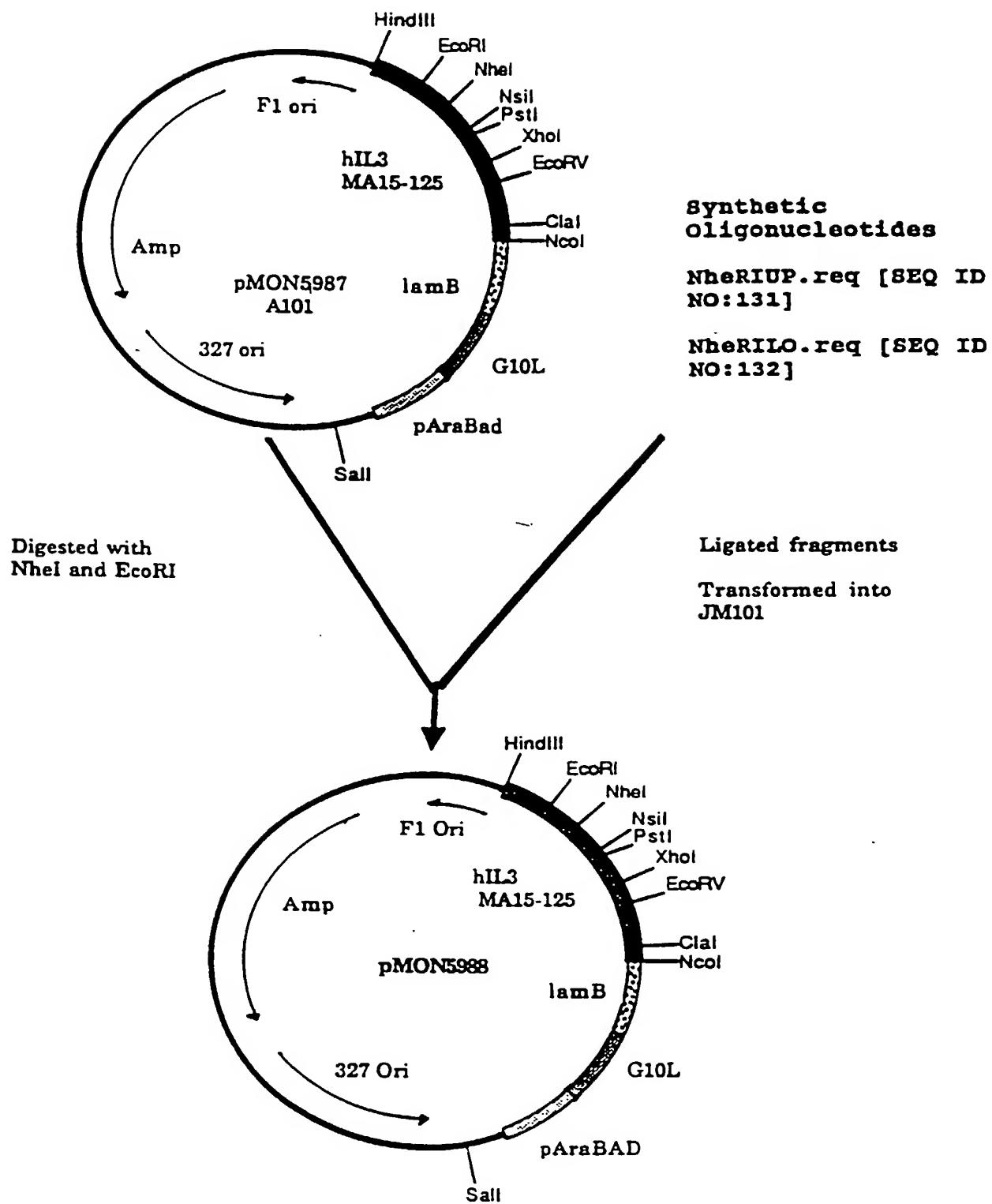
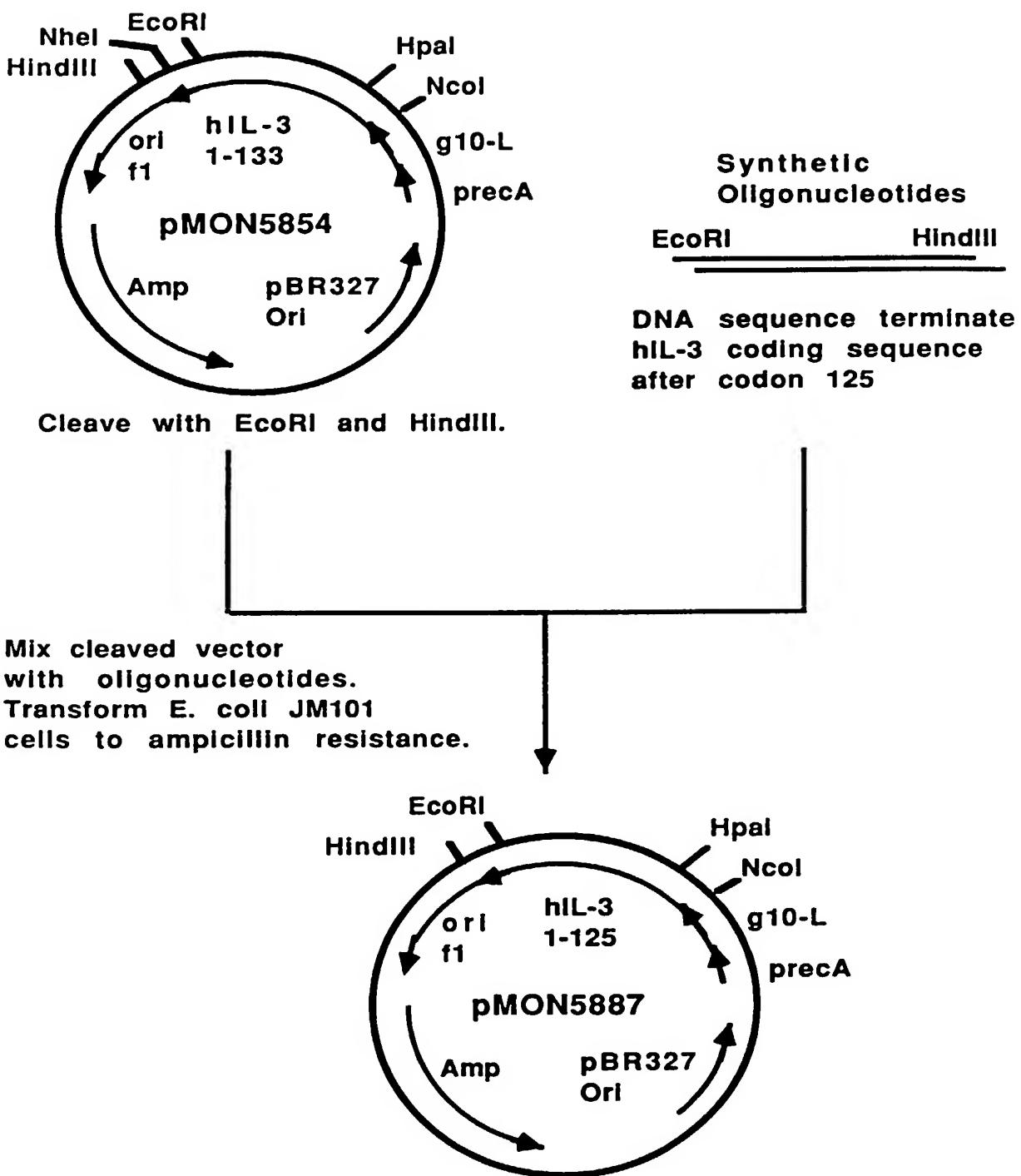
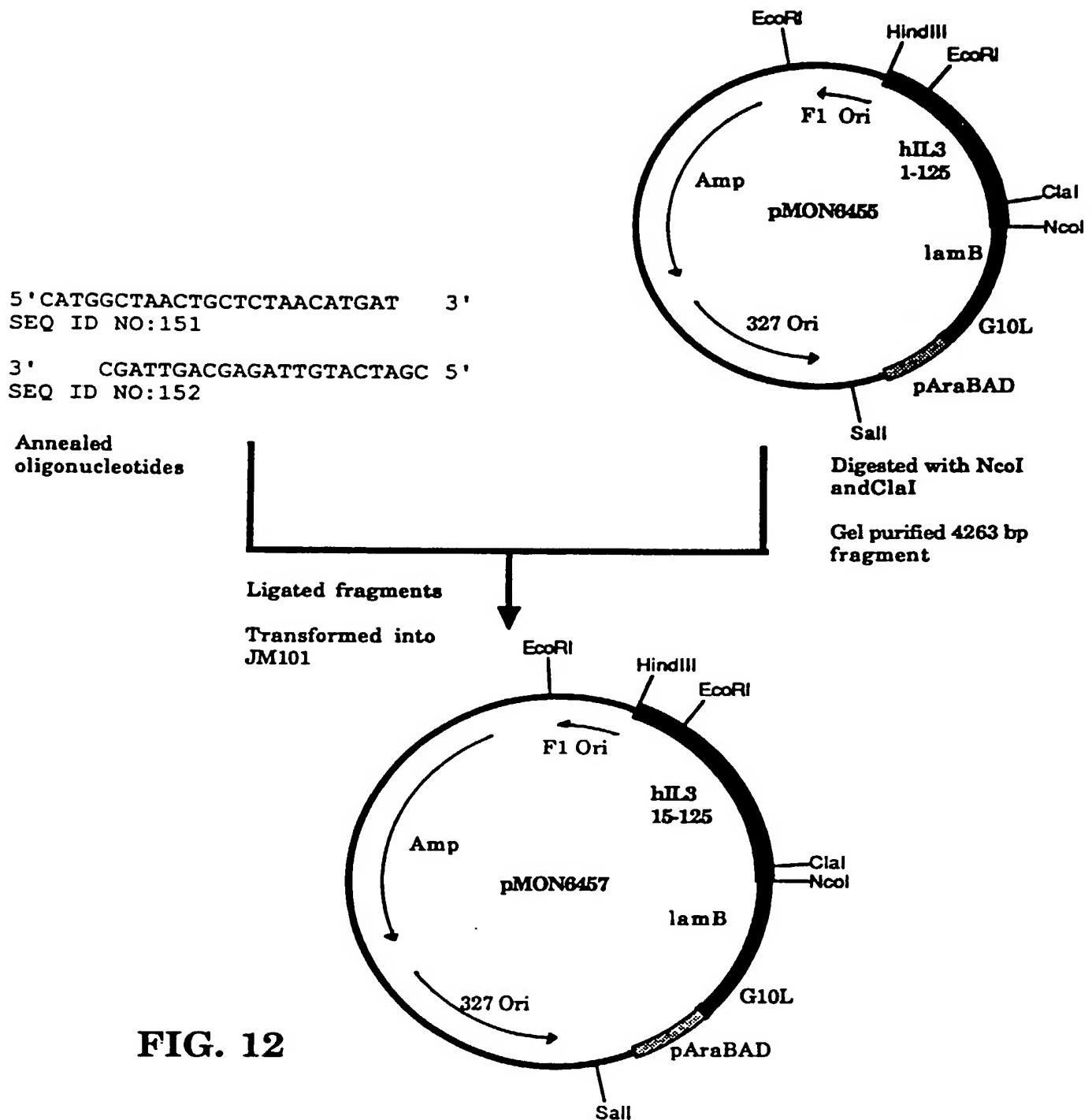
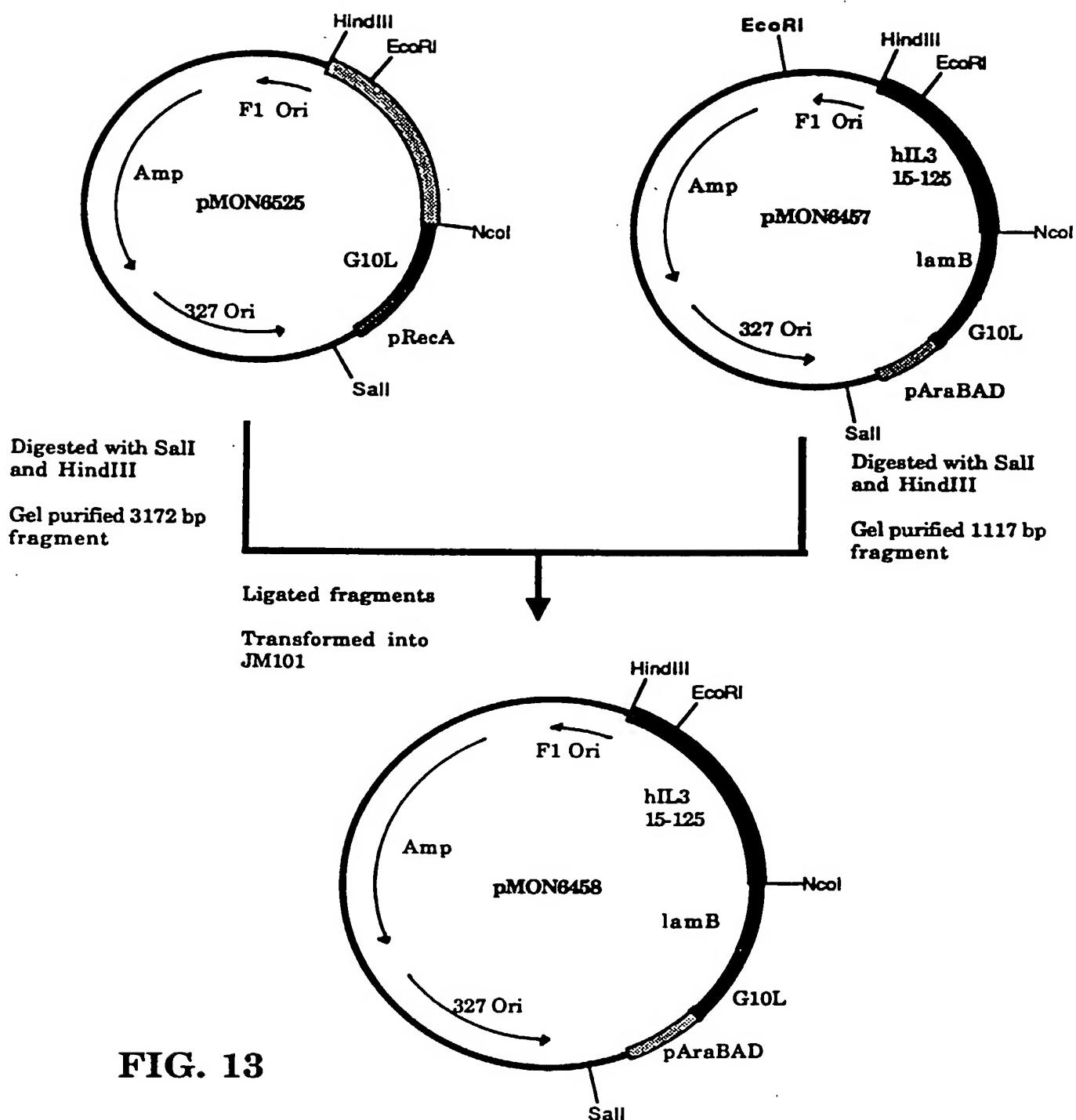
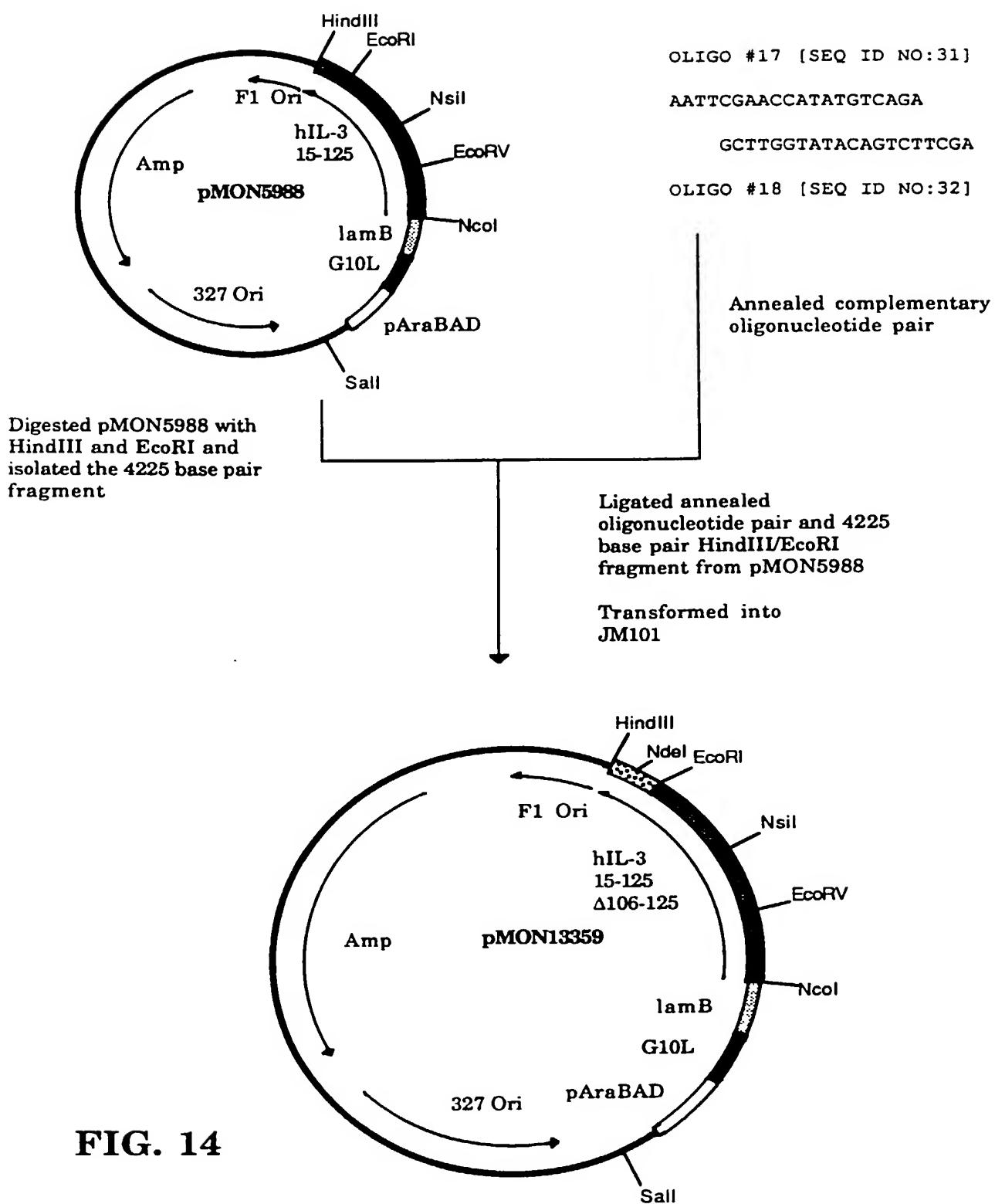


FIG 10

**FIG. 11**



**FIG. 13**

**FIG. 14**

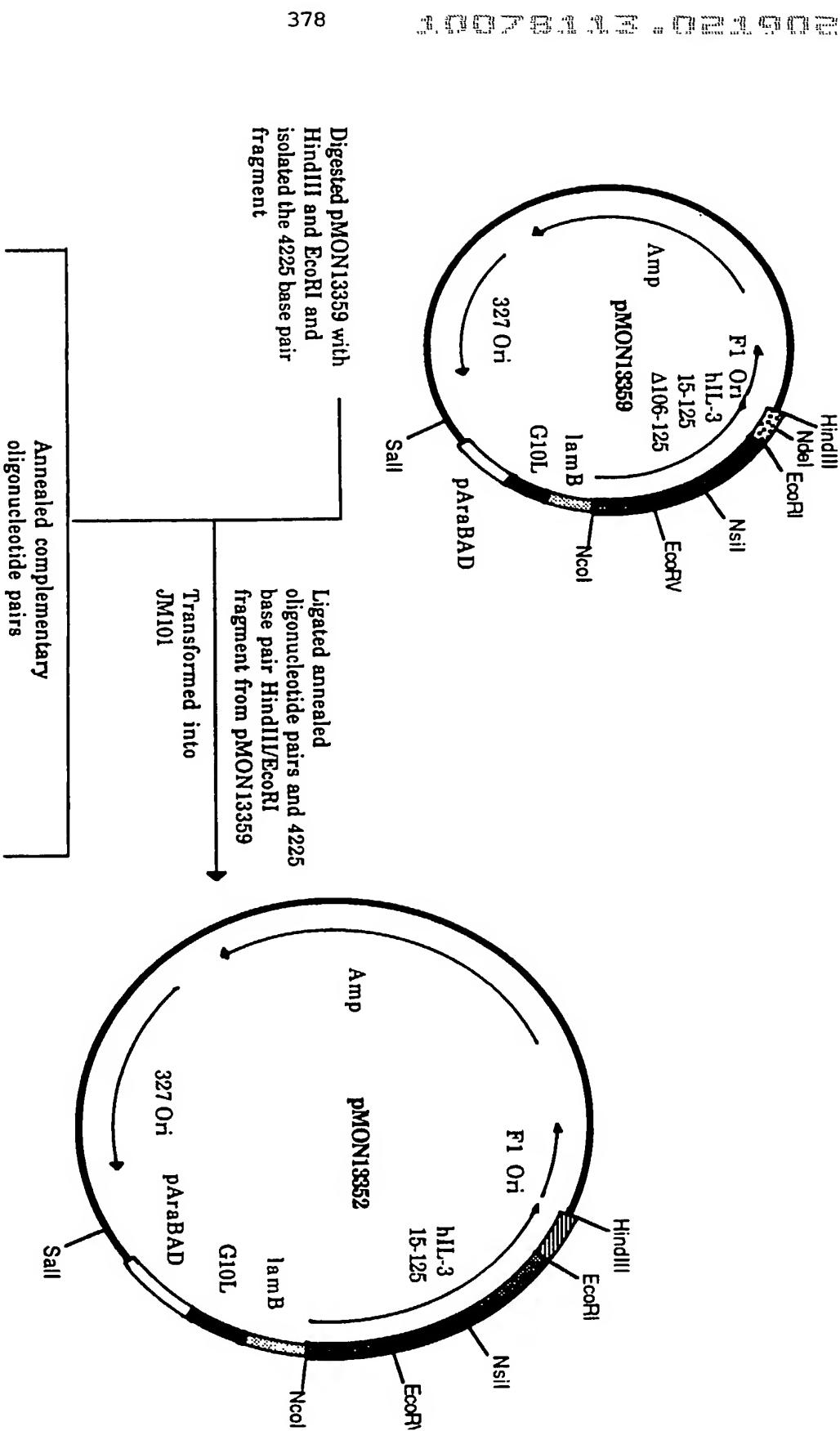


FIG. 15

OLIGO #45 [SEQ ID NO:59]

5' ATTCCGGAAAAGCTGACGTCTATCTGGTT 3'

3' GGCCCTTTGACTGCGAGATGACCAAGGGAACTCG 5'

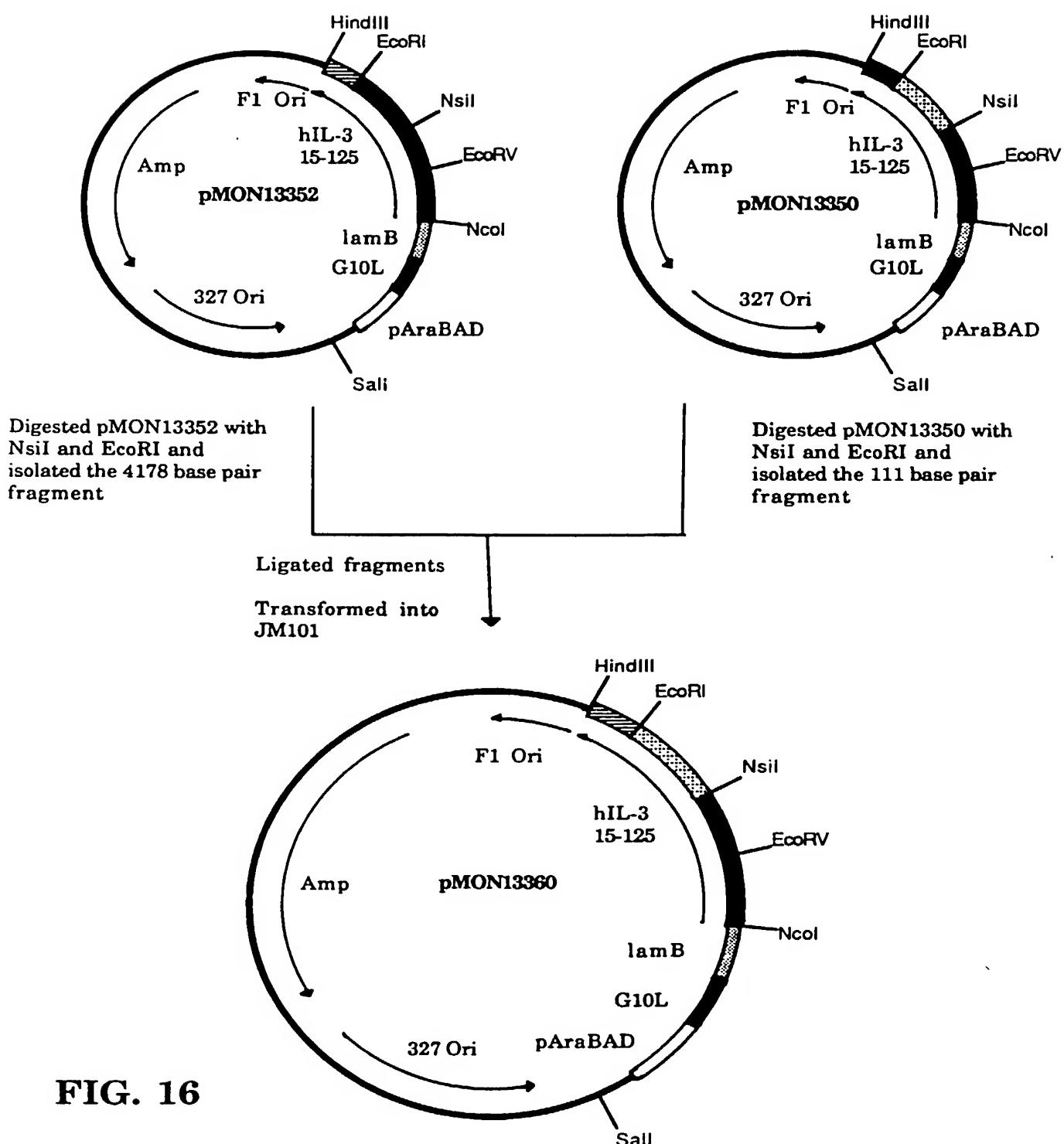
OLIGO #46 [SEQ ID NO:60]

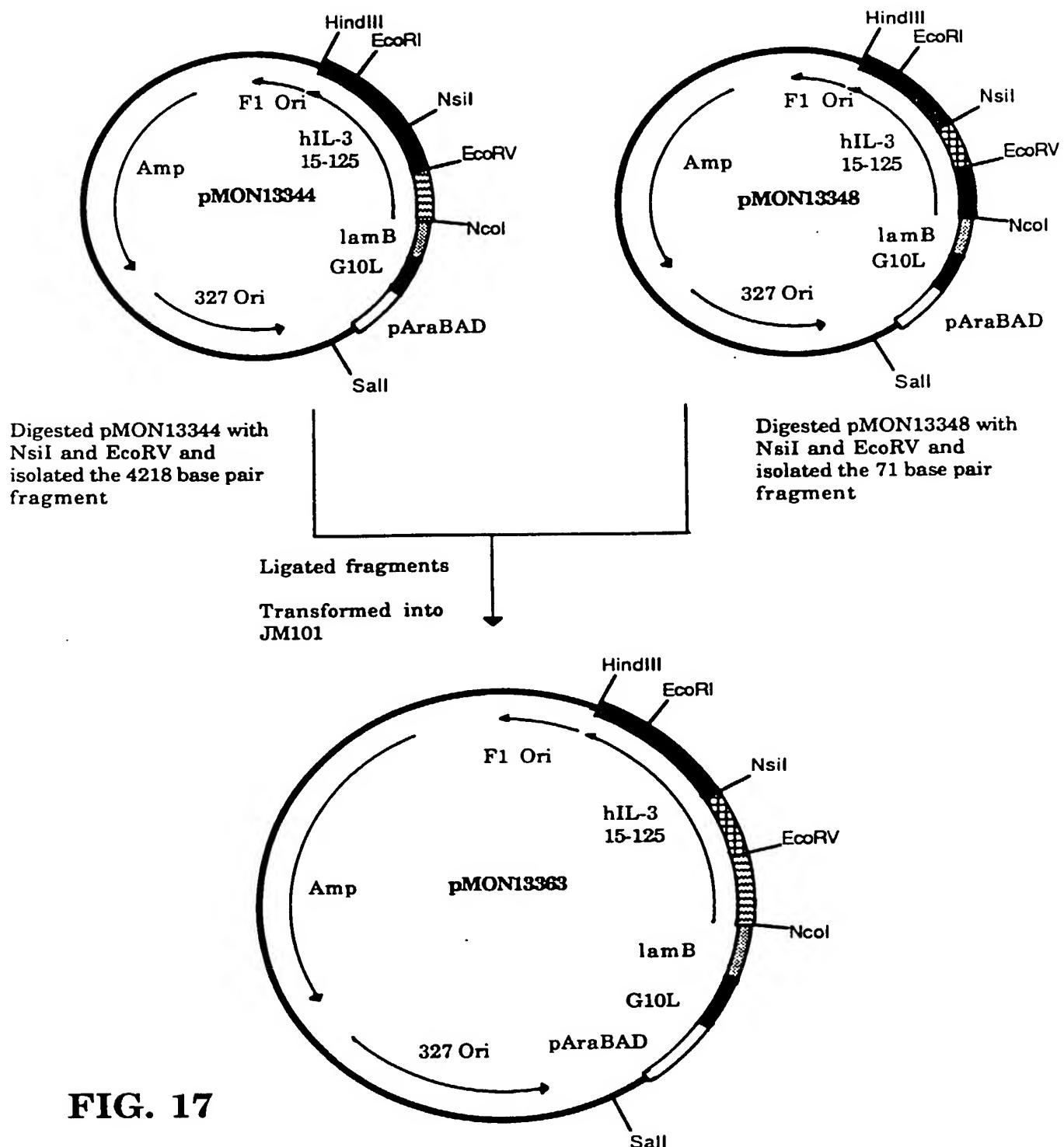
OLIGO #49 [SEQ ID NO:63]

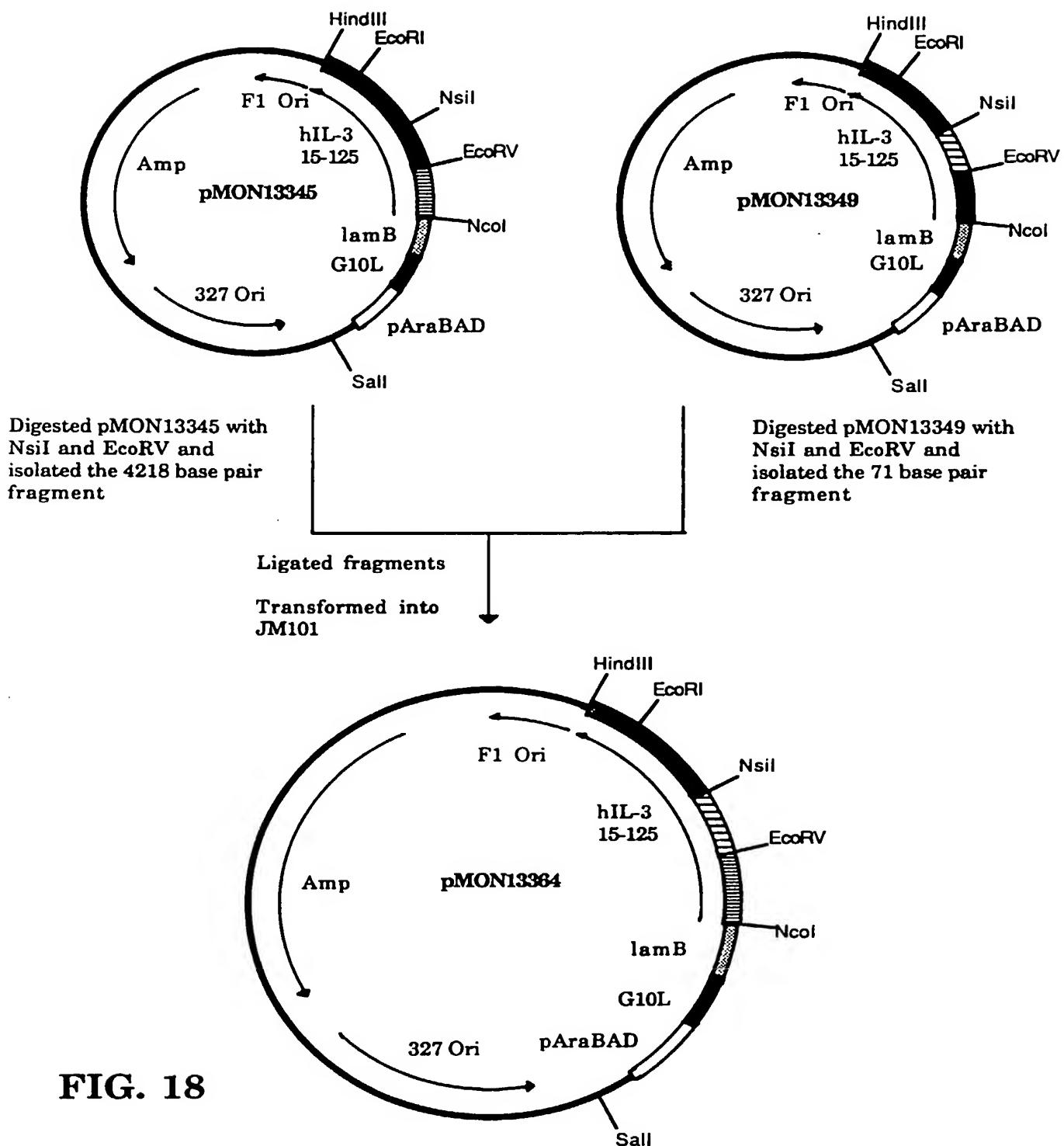
5' TCCCTTAGCAAGGCCAGGAGACACAGTATA 3'

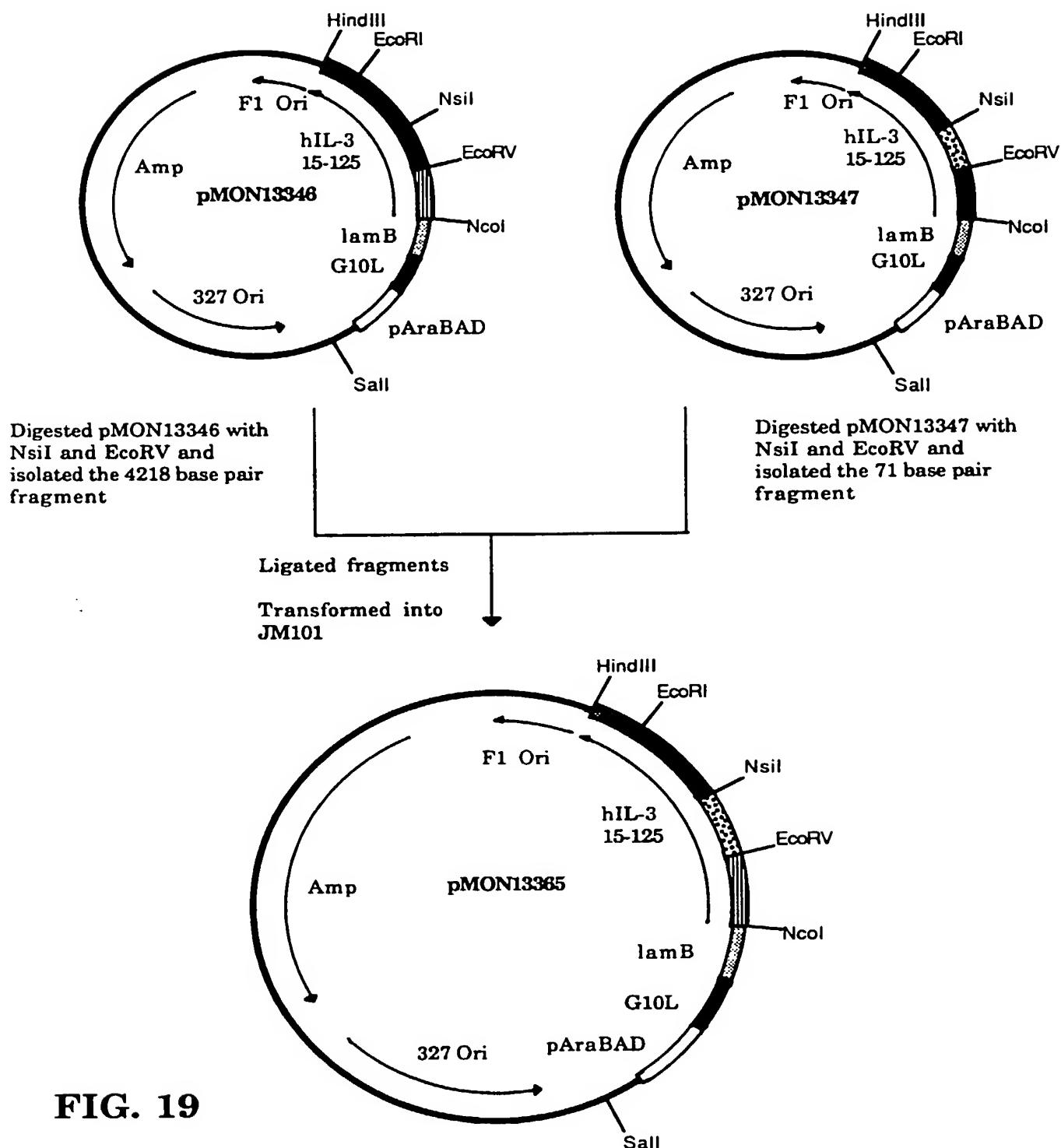
3' TTCCGGTCTCTGTCATATTICCA 5'

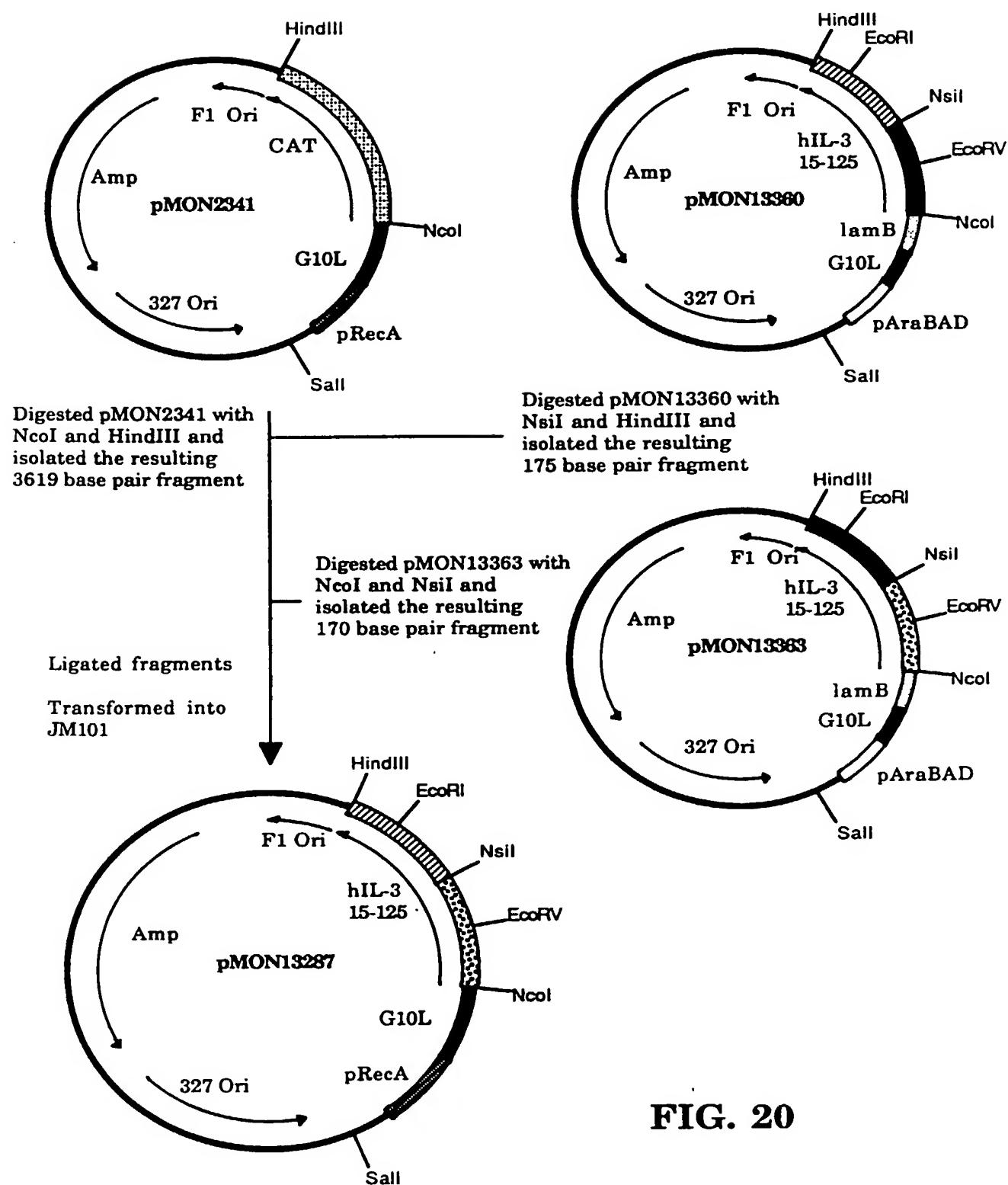
OLIGO #50 [SEQ ID NO:64]

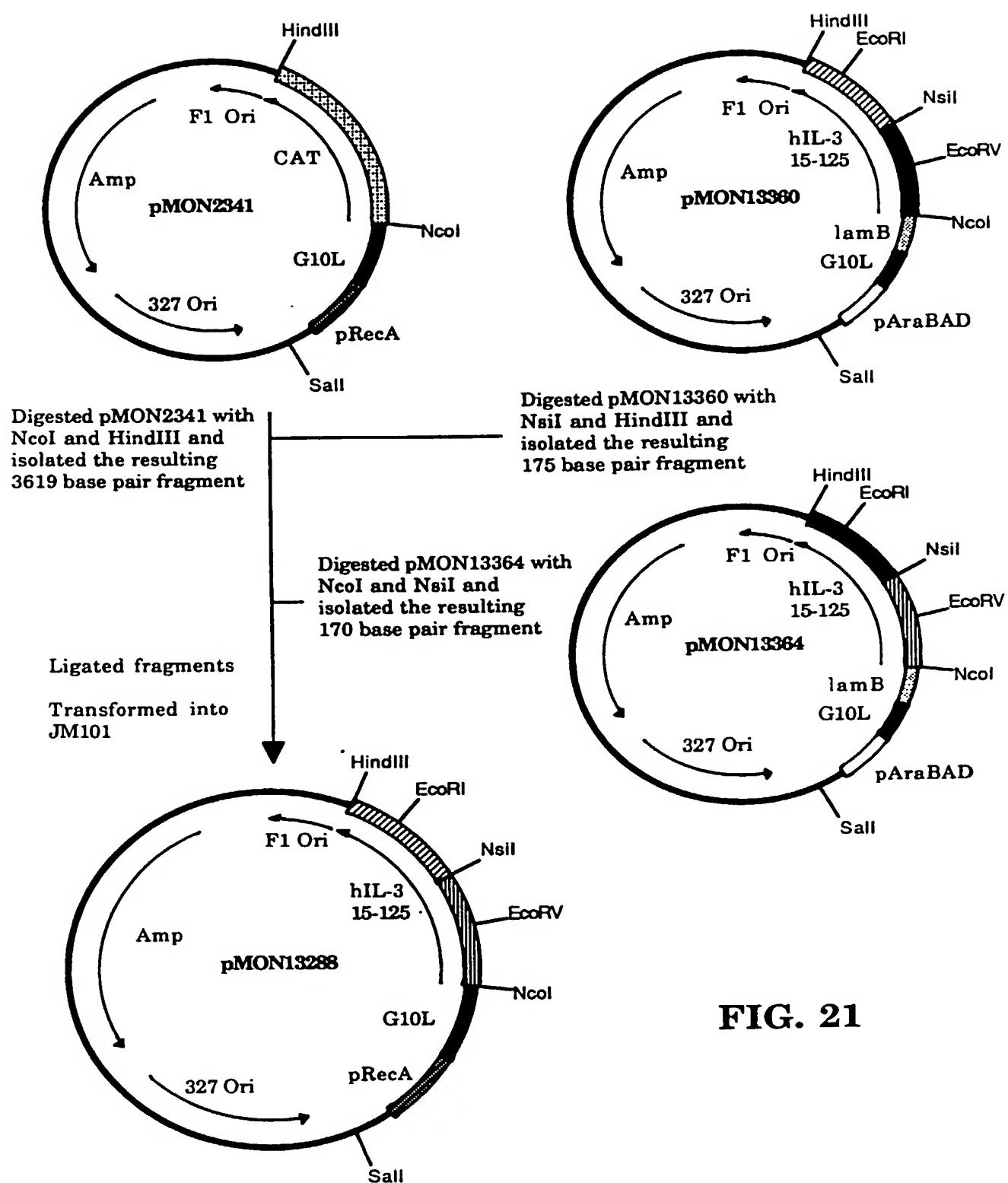
**FIG. 16**

**FIG. 17**

**FIG. 18**

**FIG. 19**

**FIG. 20**

**FIG. 21**

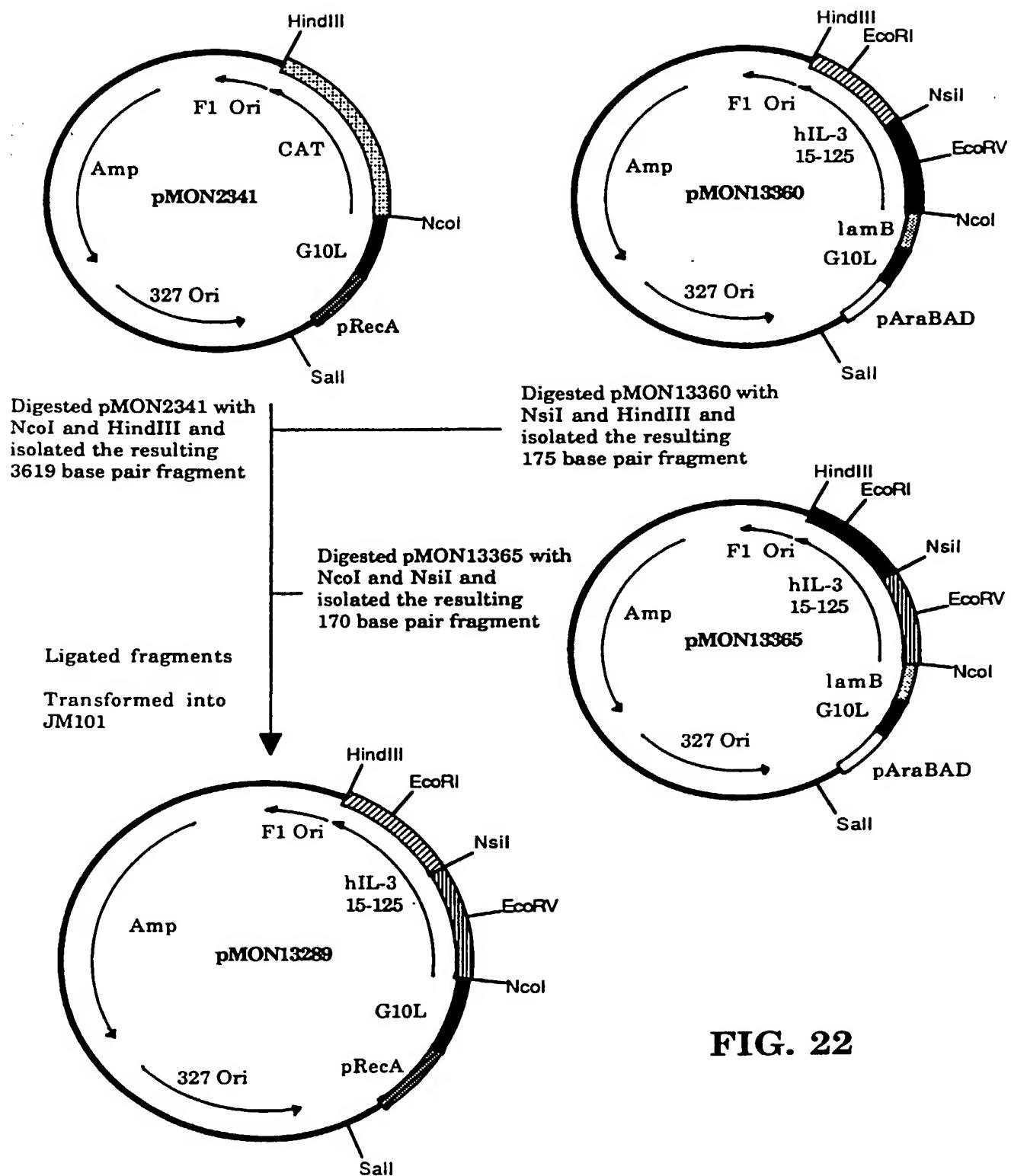


FIG. 22

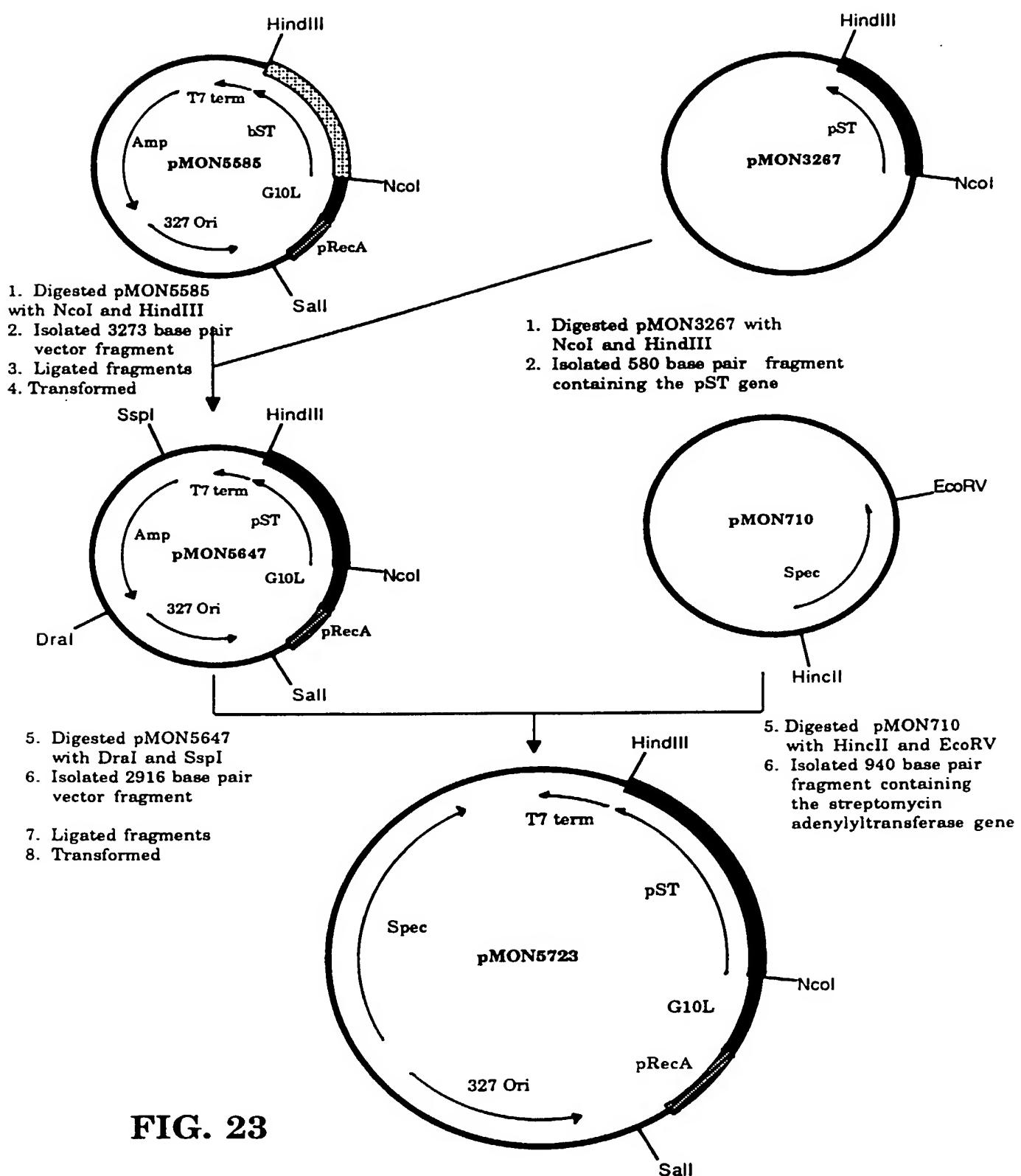


FIG. 23

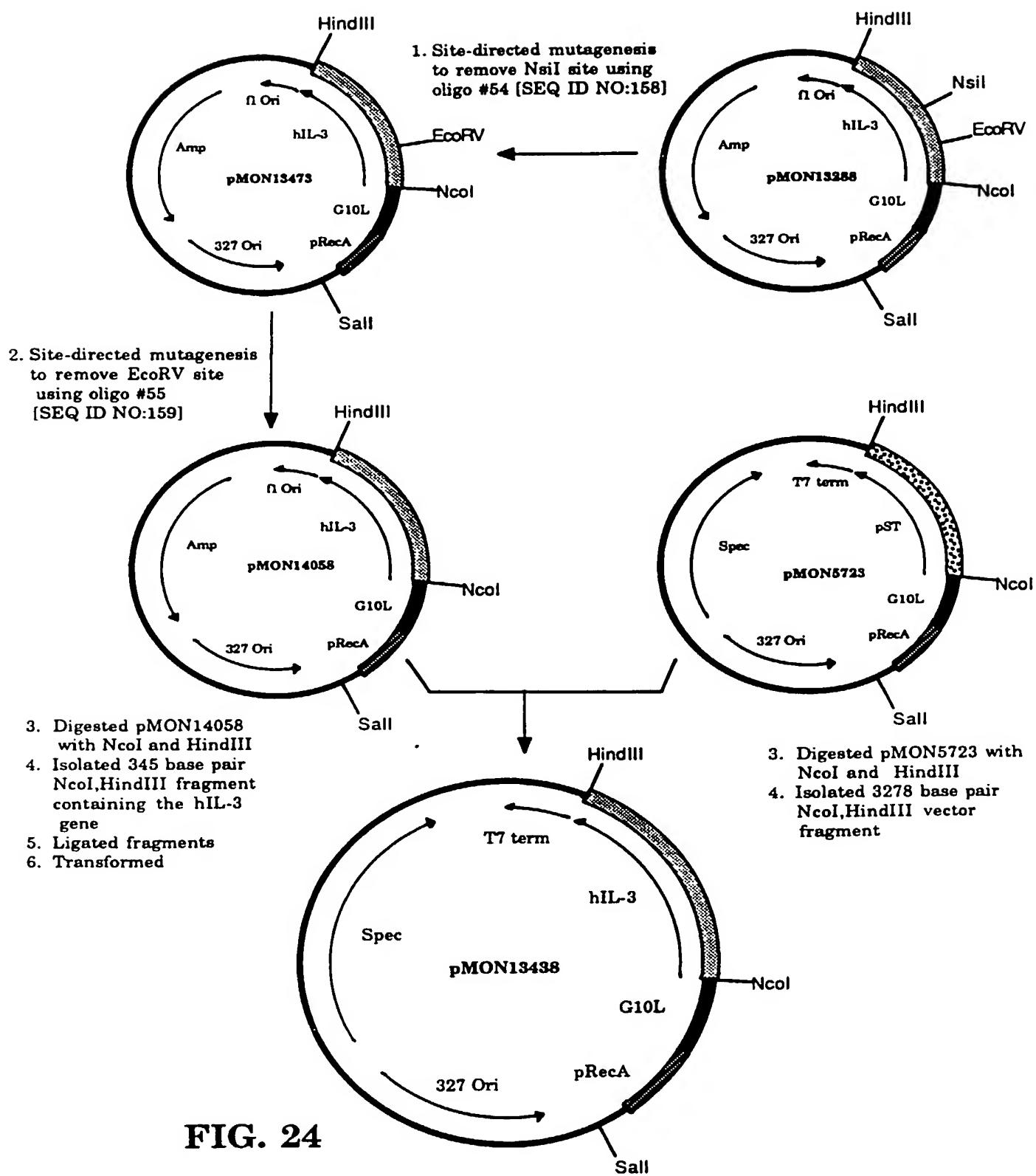


FIG. 24